The Welding Engineer

Edited by L. B. Mackenzie

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AIR REDUCTION SALES COMPANY

MANUFACTURER AIRCO OXYGEN—ACETYLENE—CALORENE—AIRCO-DAVIS-BOURNONVILLE APPARATUS
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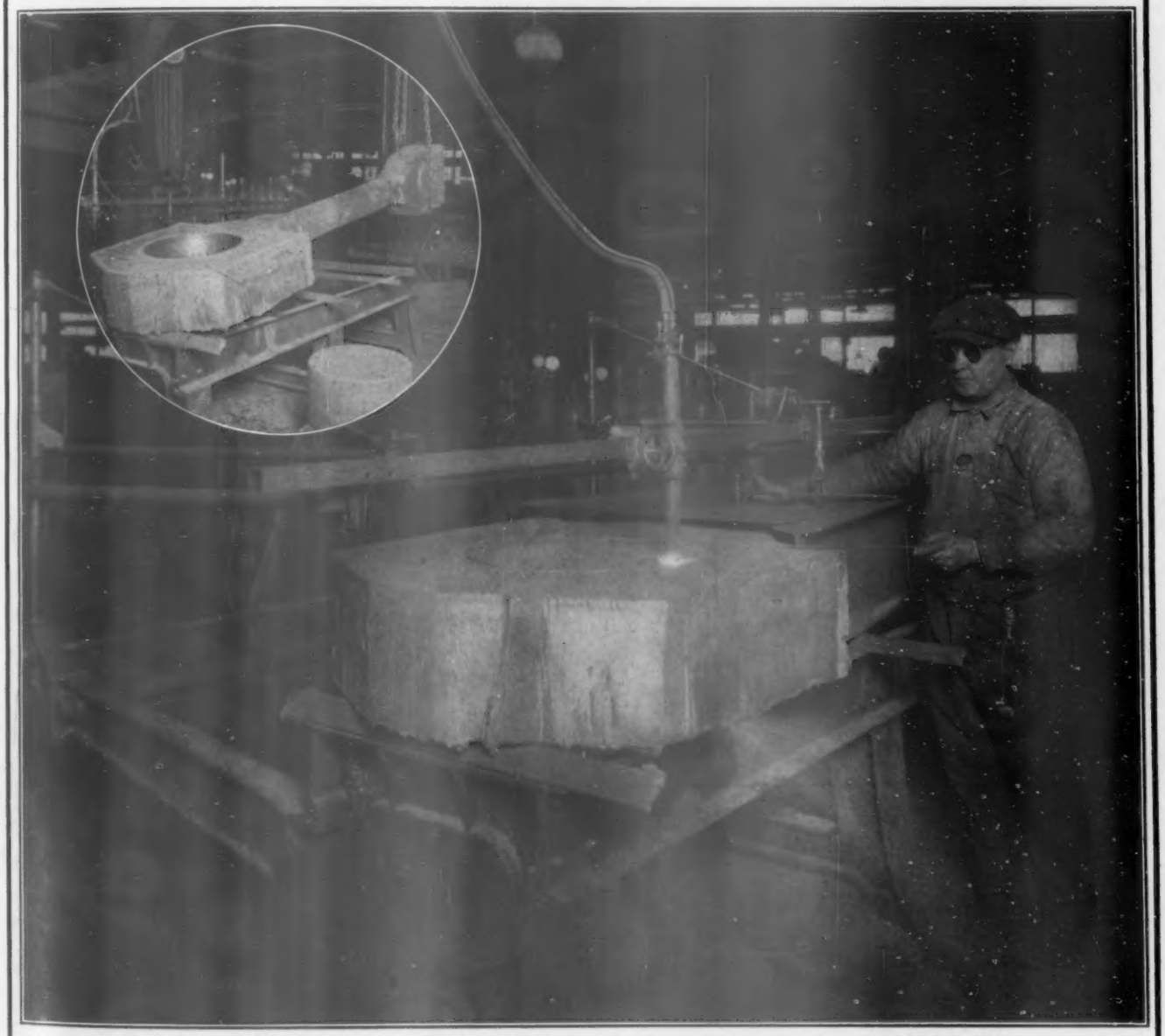

AIRCO-DAVIS-BOURNONVILLE OXYGRAPH cutting 22-inch diameter crank pin hole in connecting rod forging 12″ thick, at rate of 3½ linear inches per minute. The Oxygraph is one of several Airco-Davis-Bournonville patented oxyacetylene cutting machines.

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Before you buy and after you purchase

Repairing a paper cutter base by welding, which took only a few minutes and cost only a small sum. A new casting would have cost $6 and could not have been obtained without a delay of several days.

Repairs, yes, but salvage, too

CENTRAL WELDING SHOPS, whether working for a single manufacturer or doing general outside work, usually concentrate most of their effort on repair work. Manufacturers should not overlook the possibilities in salvage—possibilities that are indicated by one company which sends all metal material that is unusable for its original purpose to the welding department to be reclaimed in any way the foreman directs.

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Unequalled in construction
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The Cone in an oxy-acetylene flame is an indicator of a certain type of flame, and fortunately of that flame which is best suited to welding.

Its length is determined partly by the direction of flow of the gas as it leaves the tip but largely by the distance through which the gas moves during the initial decomposition and combustion of the acetylene. An increase in the velocity of the gas or a decrease in rate of combustion will increase the length of cone.

Rate of combustion depends mainly upon the thoroughness of the mixture of oxygen and acetylene and the purity of both gases. Poor oxygen or an excess of acetone in acetylene will cause an increase in cone length.

Cone length is often considered a measure of the heat or power of the flame but in reality it is a measure of poorness of the mixture and purity of the gases and the hardness of the flame, or a combination of these three things, all of which contribute to poor welds.

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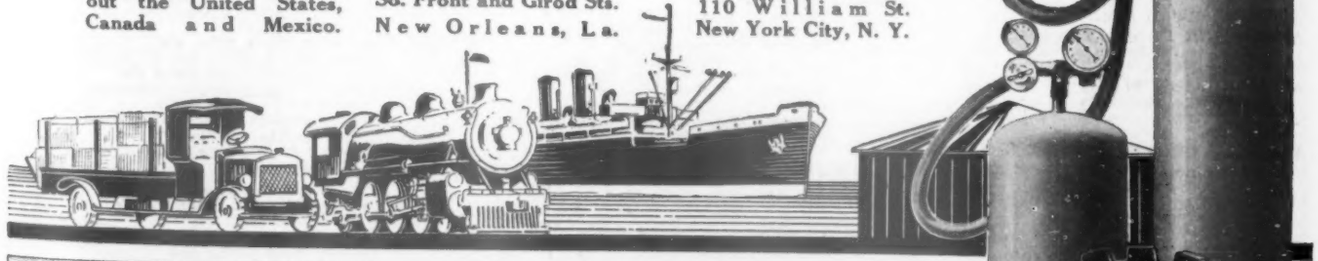

WELDING
PUROX
CUTTING

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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See "Torches"

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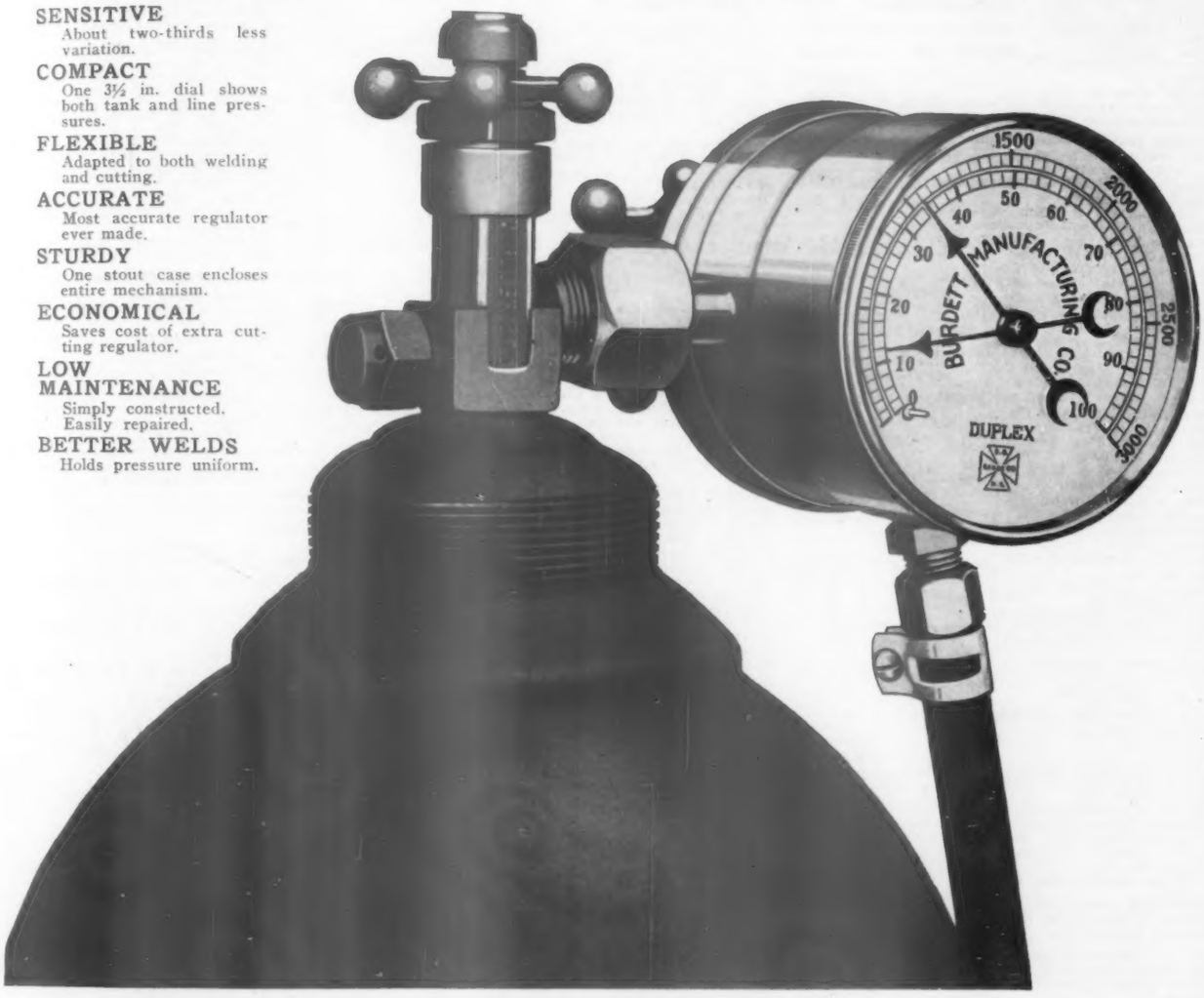

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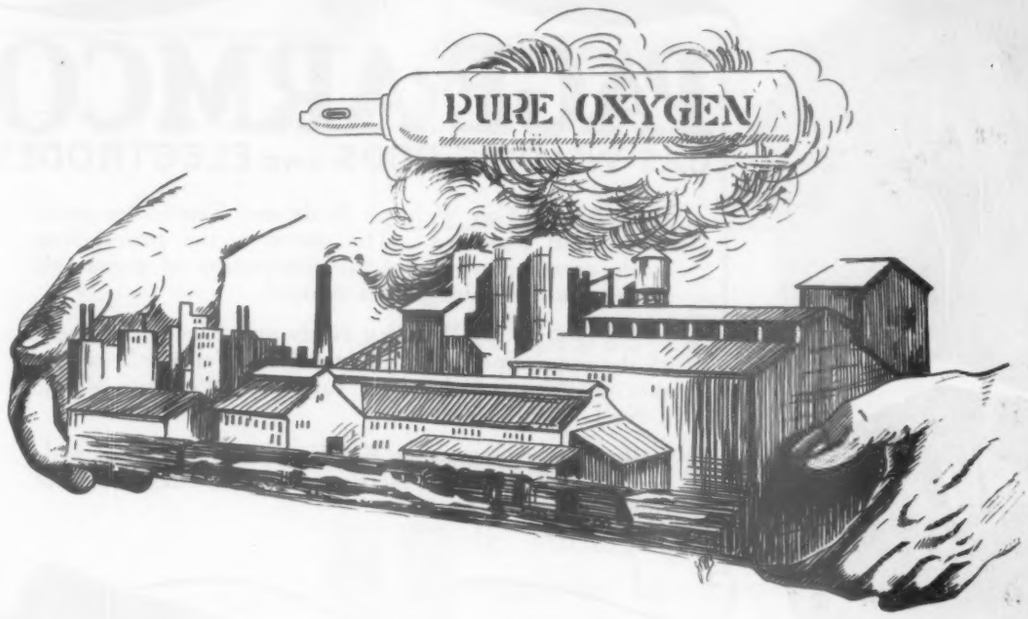

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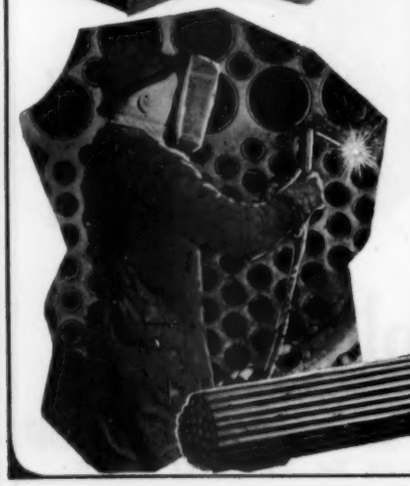

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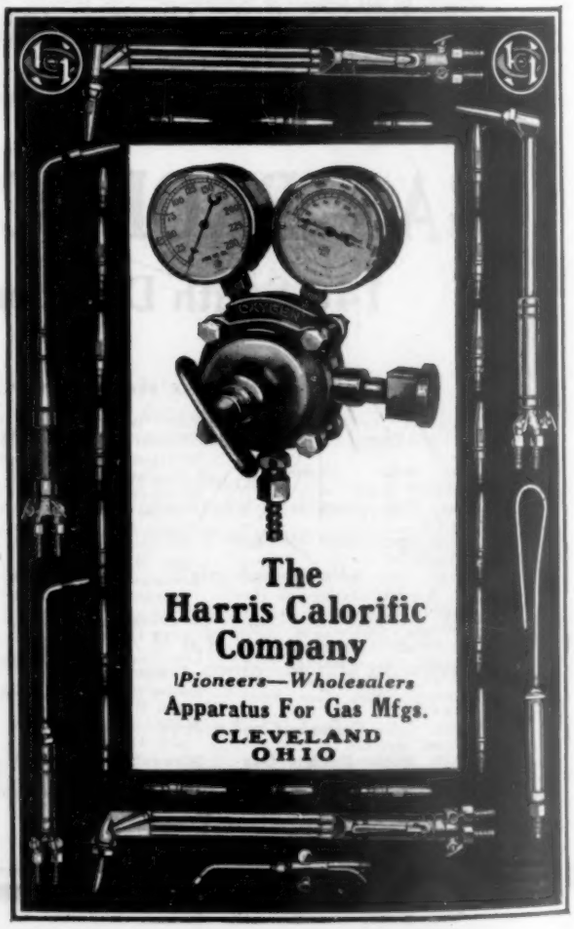

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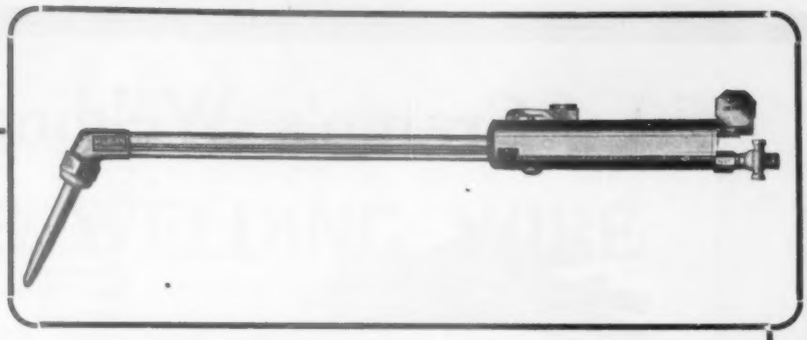

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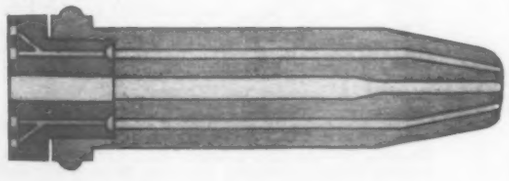

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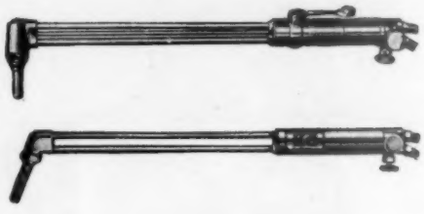

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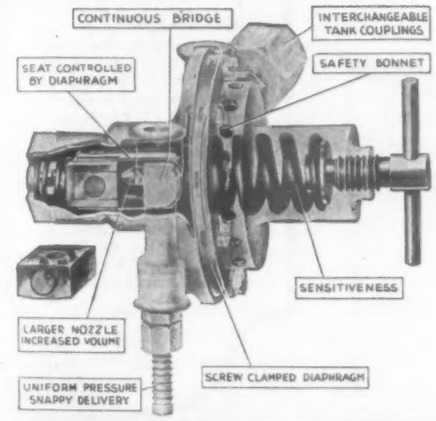

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PRODUCTION BRAZING

PART III

Careful Attention to All the Smallest Details of Process Results in Economical and Satisfactory Production

By B. Heyman

(Concluded from May Issue)

As the soldering iron which has been under discussion is manufactured in a number of sizes or capacities, all of which pass through the same operations, using a single machine for each individual brazing job, it is most desirable that there be a large quantity in each lot. This makes for efficient production, through a reduction in the overhead which accompanies the setting-up operation, and also through the added skill of the operator, which results from working on a large number of pieces of similar nature. The same condition holds true for all of the other steps in the manufacture of this tool,—machining, assembling, inspecting, etc. Naturally, this question is a matter of individual firm policy, dictated solely by its selling ability and its financial status.

In the case of the brazing operation, for example, it may take six hours to prepare the machine so that the resultant product

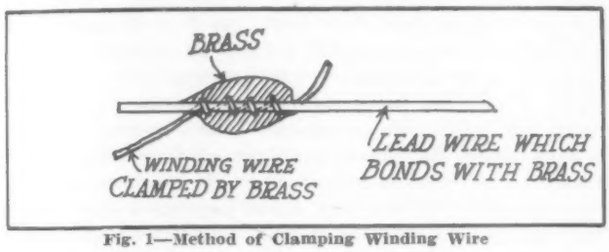


Fig. 1—Method of Clamping Winding Wire

passes the very rigid inspection which is made before the regular run of work is permitted. Assume that a lot of 1,000 pieces is to be made, each requiring 1½ minutes of actual brazing time, with a loading time of ½ minute (this containing a fatigue element distributed over an entire day). Based on a 8-hour day it would be possible to turn out the lot in approximately 4 brazing and loading days. Add to this the setting-up time, and such time as would be needed for cylinder changes and minor adjustments and it is found that the total time for turning out 1,000 pieces is 5 days. The setting up time would therefore equal 15 per cent of the total time. On the other hand, were the quantity doubled, that is 2,000 pieces, the setting-up time remaining the same, this percentage would equal about half of the value given above. Furthermore, it has been ascertained from practical observation that the former average of say 200 pieces per day would be slightly increased, thus further reducing the unit cost per piece. The opposite holds true, however, if the number of pieces should be decreased, and is to be avoided as far as possible.

The ideal condition would be to have a machine for each size of tool on each brazing operation excepting where changes in torch alignment are unnecessary. But this entails the rental of a large floor space and an investment in machinery that is warranted only if the type of commodity is in large enough demand and the concern is financially capable of expansion.

The cases having been brazed, an inspection is made by averaging from various parts of the lot. This consists in taking pieces at random and making a visual examination. The borax formation is chipped from the top of the brass, permitting a clear view of the surface. If a number of pieces appear to be defective the entire lot is examined and those that are rejected are kept in a separate container properly tagged, for a later test, which is used during the machining.

The work of machining consists in dressing the lower end of the case, where the joint has been made to the ring and stem. Before applying any tool to the case, the latter must be trued up. This is done while the case shell is held in the chuck, by pressing a wooden bar against the extreme end of the stem, the case rotating at a fairly high speed. By this means also, loose stems are discovered. The leverage caused by pressing against the stem produces an abnormal strain which a faulty joint is unable to withstand.

Then the cases are turned around and machined from the inside, producing smooth finish where the brass has been introduced. The upper end of the shell is slightly expanded, preliminary to the final assembly and brazing. It is the machining of the inside of the case which has made it necessary to use borax as the flux. Although standard brazing fluxes produce a perfect product and show consistently good results, yet the difficulty encountered in the removal of the fused surface has discouraged the use of compounds. With the borax flux, the surfacing tools stands up for a longer time without regrinding.

In machining lubricants are used. These must be entirely removed before brazing. Also, wherever a burred edge has been produced, a reaming operation must be performed. To remove all traces of oil and grease, the cases are packed into woven wire baskets and dipped, first into boiling lye, and then into boiling water. Complete removal of the foreign elements is thus effected.

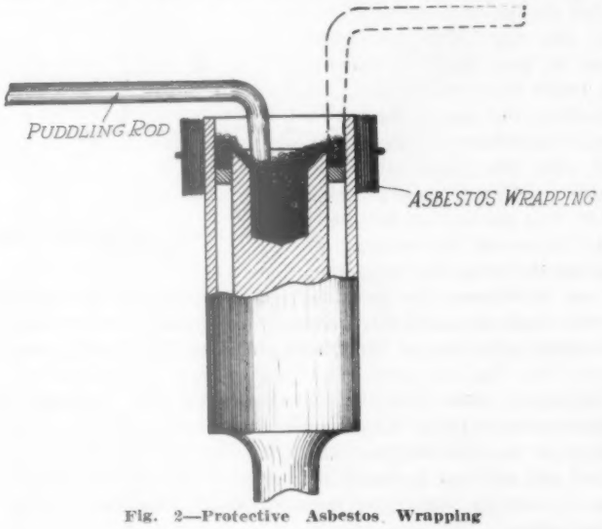


Fig. 2—Protective Asbestos Wrapping

Also, through the introduction of sufficient heat from the boiling fluids, the moisture which adheres to the cases is evaporated, preventing oxidation of the steel surfaces.

The entire interior surface of the case is then scraped with rough emery cloth while rotating at a high speed, to remove scale formation and to polish the surface. Also the outer edge of the case is smoothed by means of a tapered reamer. After washing in gasoline and thoroughly drying, they are ready for the core assembly and core brazing.

The core consists of a heavy copper cylinder, cut to length from bar stock, upon which has been pressed a steel ring at one end, and at the other end has been inserted an insulator held by crimping the copper into a groove in the insulator. Between the two members on the core is a double winding of fine resistance wire carefully insulated by mica sheets. The ends of the resistance wire are brazed to the ends of heavy copper leads which are twisted into holes in the insulator. The joint used in uniting the wires is peculiar to work of this nature in that

only one member is actually brazed. This is due to the chemical composition of the resistance wire, which will not combine with the brass, while the copper lead wire does take the brass readily. Therefore, the winding ends are twisted around the leads and a bead of brass run around the two, making what is termed a "clamp joint." Although partly mechanical in nature such a joint is remarkably efficient in conducting the electrical current. When the brass contracts during cooling it grips the winding so very tightly that no case has ever come to light where failure has occurred due to the wires parting. The joint is illustrated in Fig. 1.

This core assembly is pressed into the expanded portion of the case, care being taken to seat it on the entire circumference. By means of properly designed tools the seating position of the core is made positive. Any variation in height means fluctuations in the brazing which is to follow, and, since the core brazing is a complicated process made up of two stages which must coincide, exceeding care is exercised in turning out a perfect job.

Preparatory to brazing, the surfaces which are to form the contact area are carefully scraped with hand tools, so that they become highly polished. Then the upper extreme of the shell is tightly wrapped with asbestos tape about ¾ in. wide and about 16 oz. weight. This protective wrapping is firmly tied by a loop of soft iron wire coiled around it about ⅛ in. below the top. The wrapping must be very tight to prevent the brass from adhering to the outside of the case at the top in case it overflows. Due to the fact that the cases must be highly polished before shipment, this precaution is essential. It would be difficult to remove the brass if it happened to run in between the asbestos and shell and become bonded to the steel, although this happens occasionally and results in an added operation of filing and polishing with rough emery cloth. See Fig. 2.

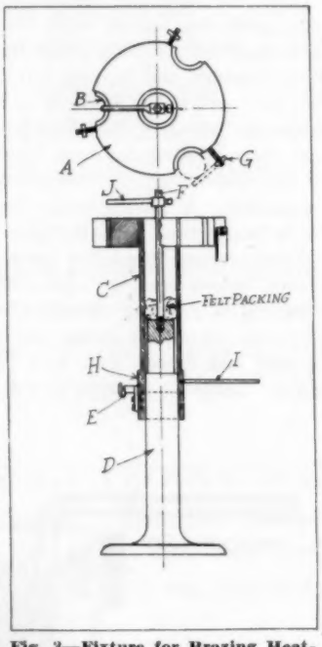


Fig. 3—Fixture for Brazing Heating Heads

The space which is to be brazed is filled with a mixture of solder spelter and flux in a determined ratio amounting to approximately 35 to 1 by weight. These mixtures are prepared as required and are kept in closed receptacles to prevent the introduction of foreign matter or moisture which may have a detrimental effect.

As the tools (designated as "heating heads" when assembled in the present status) are very top-heavy when loaded they must be set in a specially designed rack, where they are so suspended that neither vibrations nor sudden jarring of the table will upset them. Furthermore, when the work is in progress, there must be a continuous supply of heating heads at hand, ready to be inserted in the fixture at the correct time; also there must be a suitable device for receiving the finished product. The brazed heads are always red hot—actually the brass is still fluid when the tool is removed from the fixture—so that they must be held in a vertical position until the brass has solidified. The rack is set on a metal table conveniently placed near the brazing fixture, and on the table are arranged all the tools used throughout the work. There is a fixed rule in the plant that these tools are never to be removed from this table, to avoid any possibility of the operator being handicapped with his work through lack of the proper implements at a crucial moment. These tools consist of a clamp wrench, large gas pliers, puddling rods, and set-screw wrenchs.

The puddling rods are somewhat foreign to ordinary brazing work, but in this particular case they perform a very essential function—break up the spelter mixture when it begins to melt, add flux, and produce the stirring and rubbing action by means of which impurities and gas bubbles are eliminated. The rods are made to fit the work, from copper-coated Bessemer steel rods of specified diameters. They are ground and bent to fit between the shell and core as shown in Fig. 2. The bent portion is made long enough to reach the lowest point of the hole in the copper, so that the stirring can be done in every portion of the space.

In Fig. 3 is shown the construction of the fixture in which the heating heads are brazed. A is a heavy cast iron table machined to take three bushings, B, held by flat-head countersunk screws. The bushings are interchangeable and are made of varying thicknesses to hold the various sizes of tools. The method of making these is to turn down a piece of stock to the correct diameter to fit the opening in A. The cylinder thus formed is bored to the diameter of the heating head size it will take and is cut into three sectors. Part A is rigidly fastened to a sleeve, C, which bears on spindle, D, securely fastened to the floor by a heavy base.

G is a clamping device similar to the one described in Part II of this article in the description of the case brazing operation. E is an indexing contrivance which automatically locks the fixture by means of a pin which fits into grooves in the enlarged portion of sleeve, C, at H. Also in H are secured three long levers, I, which are used to rotate the table. At F is the height gage, consisting of a fixed member, F, and an adjustable arm, J. Standard heights are specified for each type of work and no deviation is permitted in setting the tools into the clamps.

The torch holders are independent of the brazing fixture and are so arranged that universal adjustment is possible with the exception of the angular adjustment of the tip from its normal vertical position. It has been found impractical to direct the flames directly into the core opening, owing to the flareback of reflected heat which envelopes the tip and raises it to a temperature at which the gas mixture ignites and burns in the torch. Therefore an angle was determined experimentally, and fixed permanently, at which this difficulty was absolutely eliminated so that the torches might be operated continuously without danger of preignition of the gases or of backfire.

In aligning the torches for any set-up, the tip is first centralized over the core, and then a slight compensation is made by pulling the torch back to overcome any tendency of the flame to burn away the sharp edge of the copper core or the upper edge of the case. The slightest deflection of the torch from the position of exact heat distribution multiplies the effects of heating a localized portion of the object by the reflected flames, and also causes lack of heat in all other sections. Scarcely enough can be said regarding this adjustment. The problem is in itself complicated enough—the production of a tool in systematic fashion every few minutes—without having to deal with a design of so peculiar a nature. It would be well to consider at this point one or two of the staggering difficulties. In the first place, there is a dissimilarity of metals and their volumes—copper and steel. The former is present in a large body as compared to a small mass of the steel. Secondly, the placing of the elements is very unusual. The copper, which melts at a much lower temperature than the steel, is so located that a light, sharp edge is directly in the path of the flames, which are deflected upwards and out, while the steel case is barely affected by the outer envelope of the flame. Yet these inconsistencies are provided for, and in a simple manner—the substance of which is the alignment and setting of the torches in relation to the heating heads.

The entire fixture is covered by a conical hood connected to an exhaust system by means of which the extremely heavy zinc fumes are removed. In the preliminary heating stage, oxidation is excessive, and, although the fume density is somewhat lessened in the final stage, yet there is such an abundance of the fine white substance formed as to require a very efficient exhauster. The hood is so designed that the opening at the bottom is large enough to afford the operator a convenient means

of handling the work—that is, inserting the heating heads, removing brazed pieces, and doing the stirring, etc. Yet the opening is not so large that it permits unusual currents to be set up in the flue, due to peculiar atmospheric changes that may occur for some reason or other.

Gases are supplied from manifolded cylinders, both the oxygen and acetylene regulators being equipped with two way pass connections at the outlet. The gases are thus distributed to the two stages of the process—the preheating and the finishing—each of which is handled by an individual torch. No difficulty at all is encountered in keeping the two torches balanced, provided the standard operating rules are maintained. Definite pressures have been ascertained, at which, with wide open valves a consistently uniform operating condition exists, excepting that slight adjustment of one of the acetylene valves produces the required balance when a change does occur. The actual balancing of the cones is based upon an equal length of excess acetylene which disappears at the same moment in both torches as the acetylene pressure is decreased. Normally, this would be the ideal condition, but it has been found that when operating, best results are obtainable when the torch which does the preheating, and which from its location in the hood receives the smaller supply of atmospheric oxygen is given a slight excess of oxygen. In this regard the process is analgous to any machine welding process, such as tube or magazine welding, in which an oxidizing flame is necessitated to offest the lack of air in the vicinity of the torches.

Originally the pressure adjustments were made by the operator carefully watching the low-pressure gauges, but this was found to be a very unsatisfactory means for controlling the heat. In the first place, the brazer had so little time to remove his goggles in order to check by careful observation what the working pressures were, that he neglected this duty to a great extent. Even if he did, and desired to make an adjustment he was severely handicapped because of the changes that were produced in the flames without any perceptible change in the pressure readings, although the product clearly showed this by a tendency to slow down or speed up.

Changes in pressure are fairly gradual in most regulators, and depends on the design, the temperature, and also the volume being drained from the cylinder. In the latest types of design the pressure drop approximates a straight line of very slight deflection from the horizontal until the working pressure has been reached, when the drop is almost instantaneous. Therefore, no trouble at all would be caused on the ordinary welding or brazing job, while on this particular type of work, even a slight change has its effect. In Fig 4 is shown a regulator characteristic as taken with a recording pressure gauge.

It was, therefore, decided to produce some form of gauge for reading the pressure very accurately for one of the gases, and depend on the appearance of the flames for setting the other gas pressure. By means of a mercury column located in the acetylene supply line this was very successfully accomplished. The readings on the mercury column were determined from the old gauge readings and carefully adjusted. By means of these, the acetylene pressure was first adjusted and then the oxygen, close observation of the flames indicating clearly whether the proper gas balance had been reached.

In cold weather, when work must be done on the larger sizes requiring a large volume of oxygen, much difficulty was encountered in the early morning hours, before the air in the vicinity of the tanks was brought to a normal temperature. This condition is similar in every respect to the one described in "The Cutting of Steel in Scrap Yards," when the cutting work is done in the open in the winter. This condition was finally remedied by using one of the completed heating heads to warm the regulator. One of the heavier sizes was connected to the lighting circuit through a rheostat and the heat deflected by means of a polished shield at the regulator.

This has also been suggested by the writer for use in other industrial plants where oxy-acetylene apparatus is used under abnormally low temperatures and where the work is of a kind requiring uniform pressures. The regulator should be supplied with a tapped hole into which could be seated (when required) a heating element containing a small copper core properly insulated and wound with a few turns of fine resistance wire, the element to be connected to an electrical circuit through a rheostat.

For setting up the apparatus very careful measurements are made so that the relation between the heating heads and torch flame is always the same. If for any reason there must be a deviation either in the pressure or height settings the change must have the approval of the management. Too much stress cannot be laid on this policy, as the individual should never be permitted any liberties with a process which depends primarily upon the adherence to certain constants.

It is true that slight changes occur which might warrant compensating adjustments. For example, slight accumulations of foreign matter in the gas passages, gas volume changes due to wear and tear of the regulators, etc. But, since careful inspections are the rule at stated intervals, with attendant discovery of any such defective conditions, they can easily be remedied, permitting retention of the old standards.

Although semi-automatic, the operation of bonding the copper core and case is one which requires a great deal of dexterity besides ordinary brazing ability. As has already been mentioned, there are three stages through which each heating head must pass before completion—idling, preheating, and finishing. See

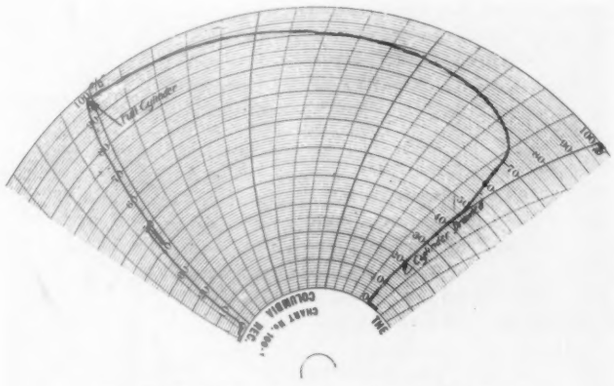


Fig. 4—How Record of Gas Pressure Is Kept

Fig. 5. In the idling position the insertion of the piece into the clamp is made. Here a small quantity of heat is absorbed, which is rapidly increased in the preheating position where the first torch acutally plays on the spleter. In the final position under the second torch the spelter is completely melted and enough brass added to fill the heating head to the very top.

Assuming that the torches are lit and flames regulated, the fixture is allowed to absorb enough heat to approximate working conditions. A heating head is inserted in the idling clamp, where it remains during the interval designated for this size of tool. Then it is indexed under the preheating torch, where a similar interval of time is allowed. In the meantime another piece is inserted in the idling clamp. At the lapse of the interval the indexing is again performed, bringing the first piece under the finishing torch, the second piece under the preheating torch and leaving the idling clamp open for the insertion of a third piece. By means of the puddling rod, which has been heated and dipped into flux, the spelter mixture in the heating head is broken up under the action of the flame, until it is thoroughly liquified. At the same time every bit of the surface which is to form brass contacting area is rubbed with the puddler to relase oxide and gas bubbles. Brass is added from a roll which is placed conveniently at hand, and at the same time small quantities of the flux are introduced into the fluid by means of the brass. During all of this time the puddling action continues. It is one of the most important requirements during the stage of the work that the addition of brass be distributed over the entire interval of time. If the brass is forced too rapidly the material solidified suddenly or becomes soggy and traps gas, air bubbles, or whatever impurities may be enclosed in the mixture and have not as yet come to the surface. If added too slowly, the sharp edge of

the copper core is very apt to be burned with a possibility of the entire piece being destroyed. Even if only a slight section of the copper is affected, it becomes noticeable when machined, due to the copper oxide bubbles which form and leave large cavities in the surface. Sometimes the entire surface is found to be pitted or porous.

If the finishing stage does not synchronize with the other stages the entire operation is thrown out of adjustment. Assume that in the finishing stage a slightly longer time has been required in order to fill the head. In the interim the piece which was being preheated has received an added amount of heat which would naturally shorten the time necessary to finish this piece under the finishing torch. At the same time the next piece would be affected in just the opposite way, so that finally it would become necessary to cease work and make a fresh start.

All of these conditions are absolutely dependent upon the absorption of the correct quantity of heat in the heavy mass of copper, and the retention of this heat without the temperature being increased or decreased while the brass is being added. This is accomplished by proper manipulation of the puddling rod while adding the brass and flux. It is surprisingly simple to control this temperature variation in the melting of the brass, although the operator's ability in this regard is governed by his experience and his alertness in recognizing the necessary action to be taken.

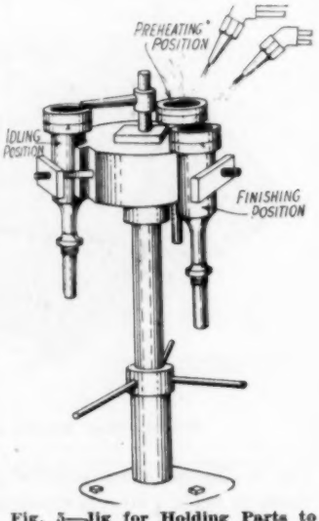


Fig. 5—Jig for Holding Parts to Be Brazed

Why the spelter flux mixture is used may raise a question, but it is only through the use of this material that the process is at all possible. The spelter grains are small and can be loaded very compactly into the core cavity. Thus they act as a solid body if metal in transmitting the heat from the preheating torch into the copper, which has an abnormal thermal capacity. By the time the core has been raised to the correct temperature, some of the spelter has been vaporized and lost, but the greater quantity has become molten and has joined with the contacting area preparatory to the addition of the main body of metal. As stated in a previous paragraph, the addition of brass must be such that the parts are not burned.

Were an attempt made to introduce heat into the parts in any other way failure would certainly result. An explanation of the whys and wherefores would take us back to the very fundamentals of oxy-acetylene technique, into such questions as expansion and contraction, thermal capacity, etc., and are hardly necessary if the problem is carefully analyzed as it appears in the drawings accompanying this article.

Because it is impossible to judge the actual temperature of the various members, or even guess at the colors which would give an approximate idea, it is one of the requisites of the job that the standard conditions be carefully followed. It would be a very simple matter, by a slight change in time, or flame intensity to make the work appear perfect, and yet have a faulty bond at the bottom of the grove where the case and ring meet, so that after the heating head has been machined the entire internal construction breaks away from the case. In fact, this has at various times occurred when the operator failed to heed instructions. Naturally where a product is worth from $7.50 to $19.50, depending upon the size, it becomes very costly for the manufacturer to make an experimental laboratory out of his production plant.

There is a heavy volatilization of brass throughout the two stages, the fumes of which are carried off by the exhaust system. Yet there is always a tendency for a slight deposit to form at the discharge orifice of the torch tip, since this is located directly in the path of the upward movement of the fumes. Therefore, the tips should be brushed occasionally to insure free passage of the gases.

At the lapse of the last interval of time, the fixture is indexed, bringing the second piece under the finishing torch and swinging the finished heating head to the idling position from which it is removed and a new piece inserted. As the finished piece is removed it is placed in the rack where it cools while being shielded from sudden drafts or chilling. Rapid action is necessary in performing the changes, to leave sufficient time for working on the heating head under the finishing torch. But this is more a matter of manual dexterity than anything else and can be acquired in a short time.

On the smallest sizes which are brazed in only 1½ minutes per stage, the operator can find time to load the pieces, remove the cold ones from the rack, and still perform all the other necessary duties in conjunction with the process.

Careful records are made of unusual occurrences and any pieces which act in peculiar fashion are marked and watched for defects which may appear after machining.

Machining operations are carried on at the same time as the brazing in order to facilitate inspection of the product as it progresses and to avoid a possible steady run of rejects due to something unforeseen in the process being overlooked. In case a number of pieces are found to be defective, the work is immediately stopped and investigated.

Defects which are checked are blowholes either in the surfaces or in the threads, burnt cores, and porosity. Occasionally a piece is machined too deeply, exposing the copper. Should the copper be burnt, and the copper oxide been dissipated the fact will be noted by the absence of the copper color in the affected section.

For a long time it was the policy of the concern to destroy such tools as were indicative of defective brazing, because of gas pockets, porosity, etc., although the heating heads may have been satisfactory in every other respect and would have given perfect service. To put the tool through the same process resulted in every case in its destruction. To introduce brass as in brass welding was also found to be out of the question as the work was of too delicate a nature. In nine cases out of ten the attempt to salvage the material caused it's absolute destruction.

It was only upon the advice of competent counsel that the management finally experimented with the so-called "hard solders" (silver solder) and discovered that a defective iron ordinarily rejected could be reclaimed and made perfect. The method resorted to, consisted in drilling out the blowhole so that the cavity was thoroughly cleaned. Then the iron was heated electrically by means of its own winding and enough heat added through the agency of a sheet metal torch to raise the brass to a temperature at which it would bond with the silver solder, using the proper flux. These irons were remachined and found satisfactory in every respect. By practical test it was determined that the heat applied to the silver solder by the electrical winding was never high enough to produce fusion even though the copper tip were missing.

Surprising to relate, the brazing does not in any way affect the winding on the copper unless through some unusual occurrence the brass happens to run in between the shell and ring and short circuits the winding—a very rare incident and possible only if the machining has been at fault. But the defect can be determined through the electrical tests which are given after the machining. After electrical testing, the final assembly of terminals, etc. is made and the outer surface of the heating head is polished. A series of pieces is then set up in a rack so that all of the terminals are connected to an electrical circuit and a small quantity of heat introduced into the iron until color begins to show in the steel surfaces. An air-acetylene torch is then played over the surfaces to complete the "bluing" action which produces a beautiful finish.

SCRAPPING STEEL FREIGHT CARS

Application of the Electric Arc Cutting Process to the Reclaiming and Scrapping of Rolling Stock

By A. M. Candy*

DURING the past four or five years the railroads of the country have been so seriously handicapped financially and the pressure for rolling stock has been so great that the maintenance of steel and composite freight cars has been very seriously neglected. This condition, together with the ruling of the Interstate Commerce Commission relative to limitations of percentage of B. O. cars, has placed the roads face to face with the facts that they have thousands of freight cars B. O. which must be either reclaimed or scrapped.

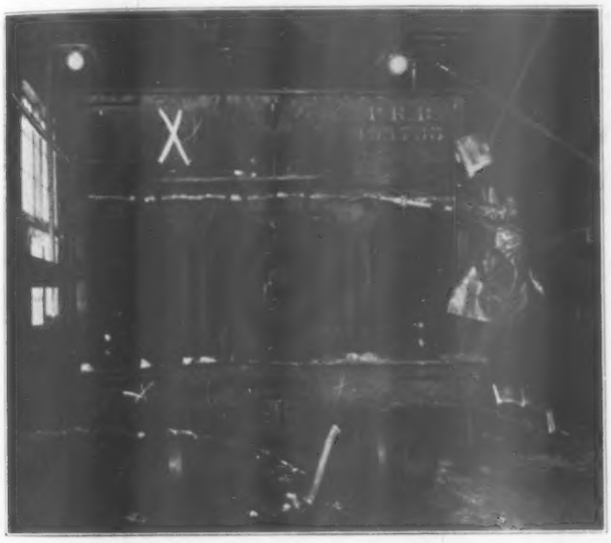


Fig. 1—Typical Arc Cutting Installation

In the past it has been the practice to turn such cars over to wrecking companies or car builders for a nominal amount and as a result a great many thousands of dollars' profit has been made by such companies which could be made just as well by the railroads, if they would make the necessary capital investment to do the work. A few of the roads have already investigated this question and have put in the most efficient equipment. Others are doing this work by more expensive methods, whereas a great many more are not doing it at all.

The problem of handling these cars is divided into two quite distinct fields, namely, (1) reclaiming and (2) scrapping. When a car is in such condition that the side stakes, cross sills and center sills are in a satisfactory state of preservation, the car is a subject for reclamation, the work required being that of cutting rivets and bolts so that the defective plates and fittings can be removed readily and new material re-riveted in position. Any necessary work can be done on the trucks and air brake equipment, after which the car is ready for painting and restoration to service.

In many instances, however, the cars are in such poor condition that the only salvage will be trucks, air brake equipment and possibly center sills. Such a car, therefore, is a straight scrap problem and can be disposed of much less expensively by straight away cutting of plates, stakes, angles, sills and other parts.

There are three general methods employed for doing this work, namely: (1) air guns or "rivet busters," (2) oxy-acetylene cutting torches, and (3) the electric arc. It is not sufficient to say that anyone of these processes is the best nor the cheapest, because it will be found that there is a field for each. In so far as the actual operating cost is concerned, the arc process, however, is actually cheaper. One road has made tests in cutting rivets, using the arc process, the results being as follows:

Labor, 1 hr., 3 min. at 90c per hour	$0.945
Electric power	0.800
Backing off rivets	0.660
	$2.405

A typical installation for reclaiming cars using the arc process for rivet cutting is shown by Fig. 1. It will be observed that platforms at a convenient height are provided along both sides of the cars, so that the operators can readily reach all the rivets. The resistor through which each operator obtains his cutting current is mounted overhead on wheels on a monorail, so that it can be readily moved along the length of the car by the operator. The cutting cable is supported by the resistor car-

Fig. 2—A Battery of Motor Generators Supplying Power for Arc Cutting

riage, which relives the operator from dragging long cable leads over the floor. This undoubtedly makes an ideal installation. Figure 2 shows the four-motor-generators operated in parallel to deliver 1,000 amperes each, thereby providing capacity for a total of eight cutters at one time, using from 400 to 600 amperes each.

The building illustrated is used exclusively for the work of cutting off the rivet heads. The cars are then removed to another building where the rivets are backed out by means of air guns, the old plates removed and new plates riveted in position.

At another installation where cars are scrapped, some rivet heads are cut off, but in addition sufficient cutting through the plates and angles is done (see Fig. 3) in a building similar to that illustrated above, so that the cars can be switched under a crane, as shown by Figure 4. The car sides are then knocked out by the crane operator swinging a large skull cracker ball through the sides of the car. This ball can be seen in Figure 4, poised in mid-air, appearing just above the rear crane track. In a few minutes' time the car is reduced to the condition shown by Figure 5, where a gang using a rivet gun is shown cutting the few remaining rivets necessary for the complete destruction of the car.

Actual records at this plant show that ten men can cut up thirty-six cars per twenty-two hour day. Individual records show that the various operators will cut from 1,800 to as high as 3,100 rivets 5/8 inch in diameter per ten hour day.

*General Engineering Department, Westinghouse Electric & Manufacturing Company.

It is manifestly obvious that the time required to cut up a car depends entirely upon the number of pieces into which the car is cut, or in other words the number of feet of cutting. In some instances as high as 240 to 250 feet of cutting is being done on 40 foot coke cars, whereas by careful analysis this same car can be cut into 14 pieces, involving 177 feet of cutting, the pieces being sufficiently small to load efficiently in a car. This cutting can be executed by one operator in 3-1/2 to 4 hours' time, the cost of labor and power not exceeding $6.75 to $7.00, based on labor at 60c per hour for the motor generator equipment at 2c per kilowatt-hour.

In the final analysis the size of the pieces into which a car must be cut is entirely dependent upon the material handling facilities of the company receiving the scrap. In some extreme cases it will be found permissible to cut a car straight through from side to side, cutting it into three or four sections, the sides of which can be mashed over against the bottom where a crane is available to swing a skull cracker ball or an old truck.

One railroad company has found that it is only necessary to cut hopper bottom cars at the corners and around the sides just above the bottom, having the sides, ends and bottoms full size approximately as follows:

Sides 30 feet 5 inches long by 9 feet wide.
Bottom 30 feet 5 inches long by 9 feet 6 inches wide.
Ends 9 feet 6 inches long by 4 feet wide.

Gondola cars are cut at the corners and the sides and the bottom is cut across the center making the sizes of the parts approximately as follows:

Sides 20 feet long by 4 feet wide.
Ends 9 feet 6 inches long by 4 feet wide.
Bottoms 20 feet long by 9 feet 6 inches wide.

When planning an electrical installation for rivet cutting or car scrapping work especial consideration must be given to the distribution system on account of the relatively high current values used and the relatively low generator voltage. Each cutting arc will be operated at 400 to as high as 800 ampres and the generator voltage will be approximately 60 volts. It is obvious, therefore, that where a number of cutters are employed the current to be handled will run into several thousand amperes which will require the use of ample copper cable to keep the voltage drop within permissible limits, namely not to exceed 5% of the generator voltage at the point where each arc is to be used. When the track is to be used as a part of the transmission system all joints must be heavily bonded. In some installations no special provisions are made for conducting the current from the car body to the rails but it is allowed to flow through the truck center bearings, journals and wheels to the track. This, however, in some cases at least is not entirely satisfactory and results in unnecessary loss as the voltage drop through the truck center bearings is considerably higher than any other part of the car body. To determine definitely the actual voltage drop through such a car under actual working conditions the ground return cable and a voltmeter lead were bolted directly to one vertical corner angle of a car body and the electrode holder was pressed against various parts of the car. The other voltmeter lead was also connected to the same part of the car with the electrode holder. The results obtained are given in the following table.

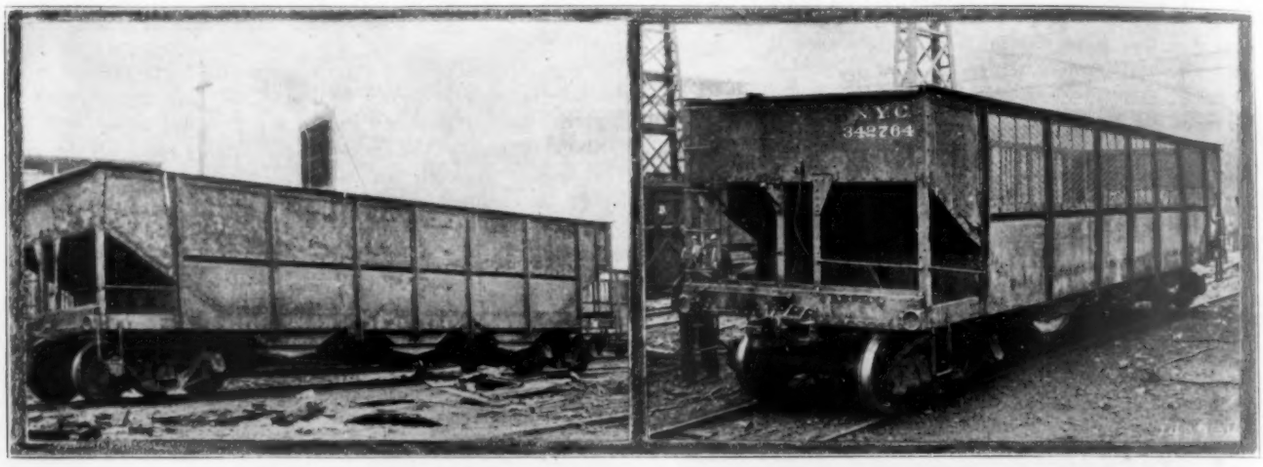


Fig. 3—Cars Cut Through Plates and Angles, Ready for Reduction to Scrap

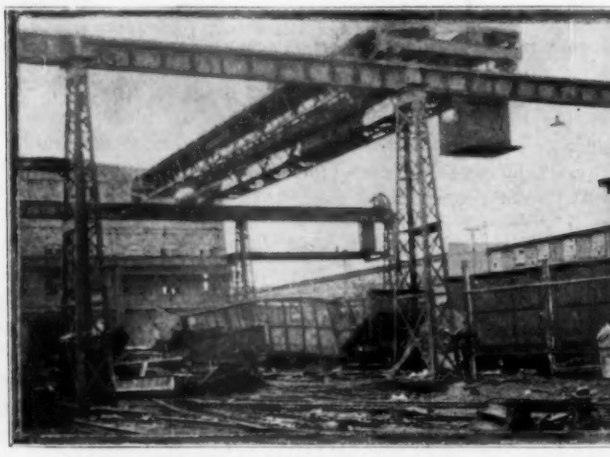


Fig. 4—The Skullcracker in Action

Fig. 5—Cutting the Lost Rivets

Position of Electrode	Amperes	Volts Drop
1st Side Stake	795	0.20
6th Side Stake	803	0.28
Top Angle	770	0.30
Far Side	811	0.30
Center of Center Sill	803	0.50

Near Draft Sill	750	0.75
Far Truck	803	3.80
Near Truck	750	4.20

Check readings were made on other similar cars and practically the same values were obtained which makes it reasonable to assume that the figures are a good average value. It is manifestly obvious that if 800 amperes for cutting is carried through the car truck there is a dead loss of over 3 kw. with a voltage drop of 4 volts. At 600 amperes the loss is almost 2 kw.

To assist the operators in the cutting work it is advisible to have suitable scaffolding or platforms provided along the sides of the cars at a height of about 6-1/2 feet. Each operator will require a cutting resistor which will have considerable weight. Therefore, it is advisable to locate a number of these resistors on about 40 foot centers under the platform so that they will be protected from the weather. A suitable terminal should be provided at the resistor so that each operator can connect his cutting holder cable to the resistor readily.

The motor-generator and switchboard equipment should be located in a building which will give the apparatus complete protection from the weather as shown by Figure 2. This also centralizes the equipment so that it can be given the proper attention by a competent electrical attendant. It is usually advisable to install two or more motor-generators of say 1,000 amperes capacity each, to be operated in parallel when the current required is in excess of 1,000 amperes rather than one large machine for several reasons. First, if one machine should fail the plant can still be operated at a reduced capacity. Second, such a plant can be operated more efficiently because if the work for a given day demands only a portion of the available capacity, only a portion of the sets need be operated.

EDUCATIONAL COMMITTEE OF THE GAS PRODUCTS ASSOCIATION IS OF MUCH ASSISTANCE TO WELDING SCHOOLS

The rapid development of the Oxy-Acetylene welding industry in the past fifteen years has out-run the training of competent operators in this trade. New applications and development of the technique of welding, have taken place with remarkable rapidity, but systematic training of operators, on the part of trade, industrial and other schools, has lagged behind the rapid advancement of the process in industrial, railroad and manufacturing plants.

Manufacturers of welding and cutting equipment have devoted much money and time to the individual training of operators through their service organizations. In order, however, to further this work, and develop an adequate number of trained operators, it is necessary to encourage and assist the existing trade and other schools, who are teaching welding, to improve and extend their present courses of instruction.

Committee Has Been Active with Schools

For the past year the educational committee of the Gas Products Association have been hard at work to improve existing conditions in the trade schools. As soon as the committee was organized communications were sent to all of the trade schools in the country, who were teaching welding offering co-operation in the establishment of systematic training and the extension of present welding courses. Some of the schools are already doing excellent work along these lines; while in others instruction in welding can be extended and improved to develop more competent operators.

Complete Outline of Training

The educational committee has prepared an outline of instruction, covering twenty-four lessons and twenty-four shop exercises. These include lecture topics, suggestions for shop work, examination questions, etc. This outline is not intended to be followed verbatim, but is so arranged that it can be extended and modified to cover individual requirements of various schools. It is particularly valuable in illustrating to the instructor the ground necessary to be covered in a thorough and practical course of instruction in welding. Schools using the equivalent of this course are placed on the "accredited list" of the Gas Products' Association and are given special co-operation by representatives of the association, who are located in the larger cities. Students are secured for the schools and jobs are secured for the students. In addition to this the committee can be of much service to institutions in an advisory way.

The Gas Products Association recently announced that copies of this course of instruction recommended for "accredited schools" can be obtained by companies, who wish to train their own welders in a systematic way. The services of the educational committee are also at the disposal of the supervisors of such welding departments. The committee can render much valuable assistance to the welding department of industrial and other corporations in developing a system of apprentice training. It has also been suggested that in cases where individual firms do not employ a sufficient number of welders to justify classes of instruction, several firms in a particular city can arrange to have training furnished in a local trade school. It has been indicated that if employers of welders in a community will assist a welding school to the extent of employing its graduates, it will be possible for the educational committee of the Gas Products Association to work jointly with such employers in establishing a satisfactory school.

The educational committee has been organized less than a year, but it has already been of much service to welders and their employers by carefully investigating all schools where welding is being taught, and assisting many of them to improve their present plan of instruction. The schools have been very glad to receive this co-operation because it has furnished them with an excellent means for improving and extending instruction in a systematic manner. There is a constantly increasing demand for good welders, and likewise an increasing demand for good welding instruction.

G. P. A. CONVENTION WILL COMBINE PLEASURE WITH BUSINESS

The key-note of the annual convention of the Gas Products Association is being held on the 9th, 10th and 11th of this month at Atlantice City, N. J. There will be an interchange of ideas on Production Methods, and Methods of Selling Gas and Apparatus. The plans for the convention are such as to enable the charter members and the new members to really get acquainted, and to enable each one to find out what the other is doing to solve the problems which are common to the gas producing industry.

Along with the important business meetings that are scheduled, a number of entertainment features have been planned so that the attendance at the convention offers a fine substitute for a vacation.

HARRIS ANNOUNCES IMPROVED CYLINDER VALVE

The Harris Calorific Company, Cleveland, Ohio, are announcing a new type of high pressure cylinder valve for use with Butane, Carbo-Hydrogen, Hydrogen, Blaugas, Calorene, Oxygen, etc. The advantages claimed for this valve are that it is not subject to abuse by wrenches because it is opened and closed by a special key inserted in the top of the valve—that it is shorter than other types of valves and no soft metal is used in the seat. Cylinders can be retested by removing the lower seat without taking the valve body out of the cylinder. It is also pointed out that valves cannot be opened in shipment without a wrench.

WELDING SCHOOL HAS SPECIAL PIPE COURSE

R. K. Randall, director of the Welding School of the Cleveland Y. M. C. A. School of Technology, writes that at present he has a group of men taking a special course in pipe welding. The course is to take twelve weeks, two nights a week. Practical exercises will be handled as nearly as possible under actual working conditions. Butt welds will be made without turning the pipe so as to give the men plenty of overhead and vertical work. T's, V's, and other joints will be made the same way. Preliminary work is done on flat scrap steel. All welds are tested by hammering with a 12-pound sledge.

LOCOMOTIVE CYLINDER WELDING

Firepot Made of Front End Netting Greatly Reduces Cost of Preheating Cylinders — Special Preheating Torch

By J. S. Heaton*

FOR successful cylinder welding the preparation of the weld and the filler metal are the most important points. If the break is along the side of the cylinder as shown in Fig. 1, at B, the break should be beveled from the top side, allowing the

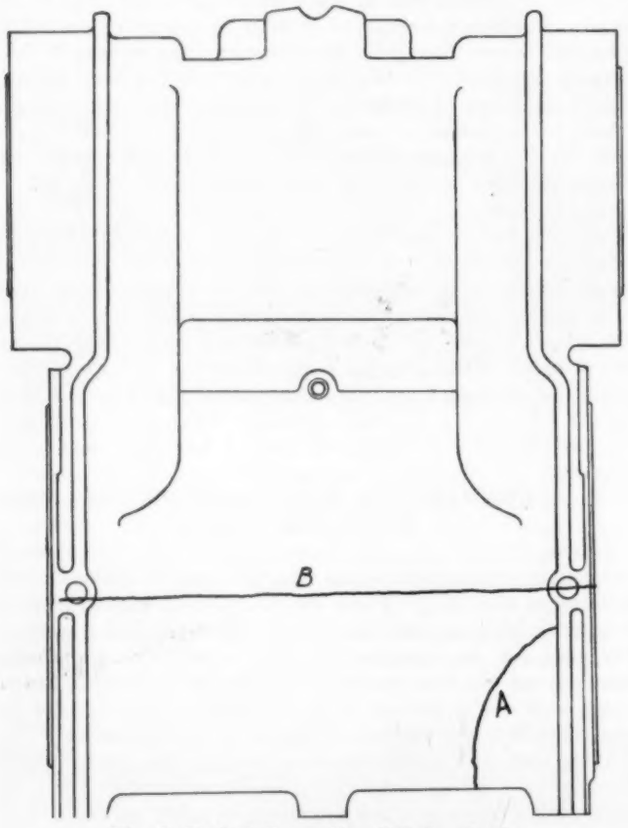


Fig. 1—Typical Locomotive Cylinder Cracks

bottom side to be square. This allows a foundation for the weld and also saves welding. If the break is around the cylinder as shown at A, Fig. 1 the break should be beveled to 45 per cent on

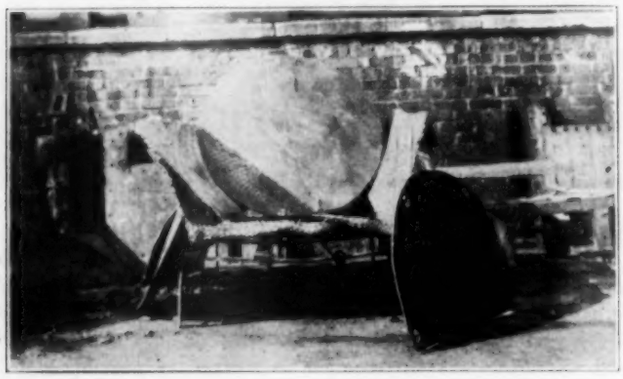


Fig. 2—Fire Pot Used for Heating Cylinders

both sides. The beveling on the bottom should be on the inside and where the break extends on a vertical line, the beveling should be on the outside. The work must be thoroughly clean before starting to weld; if dirt and oil is mixed in the weld it can not be machined.

Great care should be exercised to secure rods that have a high percentage of carbon and silicon as the heat has the tendency to lower the contents of same in the rods.

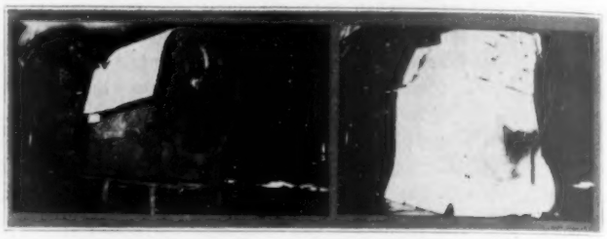


Fig. 3—Cylinder with Fire Pot Ready for Heating

Fig. 4—Cylinder Correct to Coil After Welding

Fig. 5—Oil Heater for Cylinders

Always use a neutral flame when welding, as an excess of oxygen will cause slag pockets and an excess of acetylene will cause pin holes. Start the weld at the bottom, taking care to make the proper fusion at the bottom of the weld before starting to weld. Use as little flux as possible as it is only used to remove impurities. These should be raised to the top and flushed out. Do not keep the flame in one place too long but keep it moving or the properties of the iron will be burned out. The iron on both sides of the weld should be kept hot as the weld progresses to keep the heat distributed. The cooling of the cylinder is as important as the heating. Quick cooling will cause a break or the weld will be too hard to machine.

When the bottom of the weld has been finished and the vertical side is reached as shown in Fig. 1, at A, difficulty may be had in holding the molten metal to the proper place. This trouble may be taken care of by placing a carbon block alongside the weld and extending over the V about one inch. As this space is filled, move the carbon up again and continue this method until the weld is completed. This will increase the speed in welding. A carbon block may be used to good advantage in the weld

Welding Supervisor, Wabash R. R.

as shown at B, Fig. 1, the block being placed about one inch below the break, extending outward on a 45 per cent bevel. This will hold the molten metal in place and will also allow a reinforcement to be welded over the break.

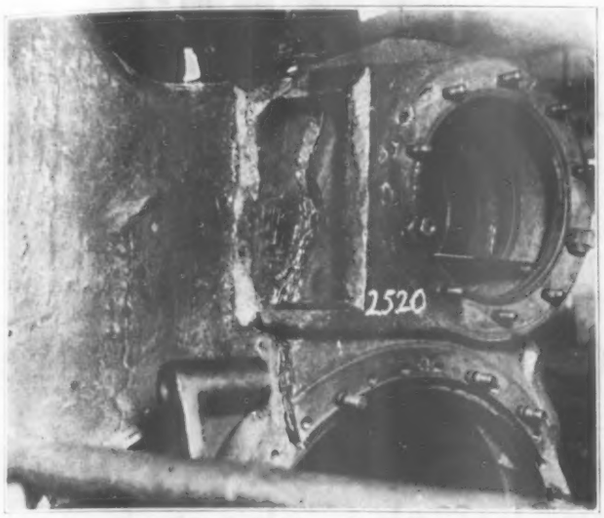


Fig. 6—Casing Cut Away to Allow Welding Inside

When welding cylinders it is the practice of most railroads

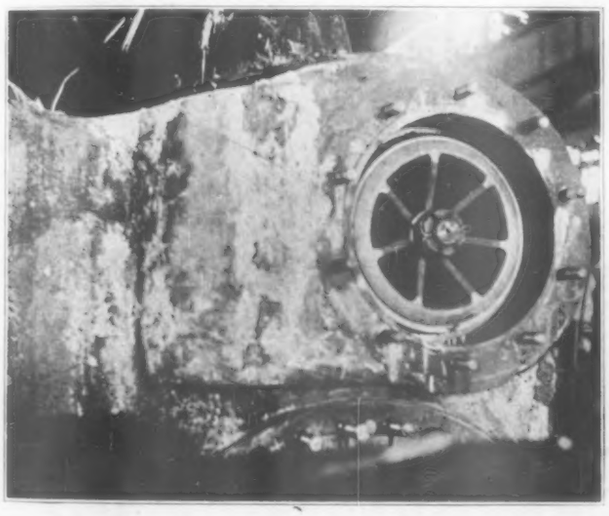


Fig. 7—Completed Weld on Cylinder Shown in Fig. 6

to build a brick furance around the cylinder to hold the heat for welding and cooling. This is a very costly method in both time and material as it takes the services of two men several

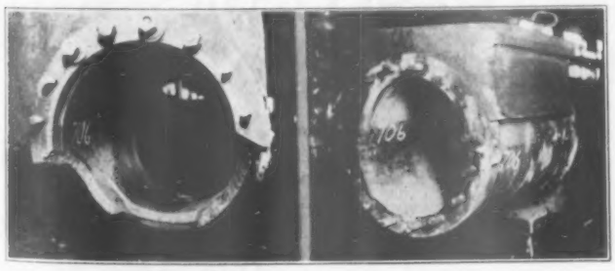


Fig. 8—A Clean Break and the Way It Was Repaired

hours to build the furnace and many of the bricks are lost in the extra handling.

The furnace which we use is shown in Figs. 2 and 3. The fire pot is constructed of front end netting and is formed in an oblong shape to conform to the shape of the cylinder, three feet wide, four feet long and sides and one end extending upward ten inches. The other end is left open to receive the charcoal during the operation. A stand is made from ¼-in. by 1-in. bar iron formed together and has legs ten inches long. Plates as shown in Fig. 2, are cut to fit over the ends of the cylinders, these being held in position by the cylinder head studs. The cylinder is lagged on top and down the sides to the fire line with boiler lagging. After the fire has been started the bottom part

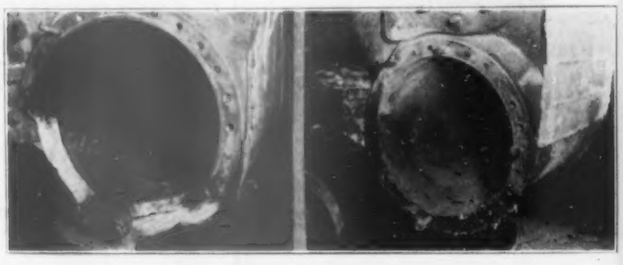


Fig. 9—Repair of Double Break on Front of Cylinder

of the cylinder and the fire pot is enclosed with ¼-in. by 36-in. sheet asbestos and cylinder is allowed to come to a dull red at the break before starting to weld. Charcoal is used for preheating, the fire pot being filled and the cylinder half filled. The fire is allowed to heat slowly without a forced draft.

After the weld is completed charcoal is added until the fire pot is filled and the cylinder half filled. Sheet asbestos is placed around the cylinder, being careful to exclude all air possible, and the job is allowed to cool slowly. This is shown in Fig. 4.

With this method there is nothing lost except the asbestos nearest the fire and the charcoal which is used for heating and cooling. One man can prepare a cylinder for welding in a short

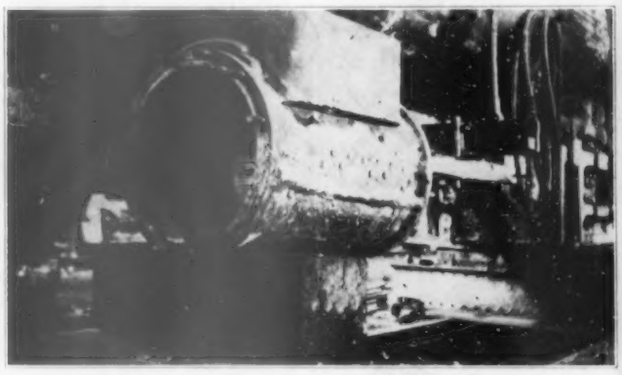
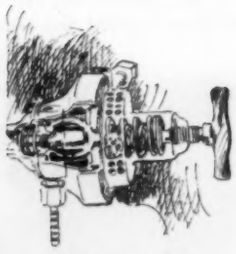


Fig. 10—Welded Crack Full Length of Cylinder

time. A cylinder can be welded by this method while one is being prepared by the old method. We have not lost a single cylinder by this method and have used it for several years.

For welding breaks, as shown in Fig. 1, at B, a preheating torch, as shown in Fig. 5, is used. This torch is constructed from a 4-inch pipe with four rows of holes 6 inches apart. It is inserted in the cylinder, being held in position by two plates which are fastened to the cylinder with the cylinder head studs. The torch is used during the welding operation and is then removed and the fire pot, as shown in Fig. 3, is placed underneath, charcoal is added and the cylinder is lagged and allowed to cool in same manner as in Fig. 4.

Fig. 6 shows a cylinder cracked so badly that it was necessary to cut away the outside casing in order to have access to the break on the inside. Fig. 7 shows the completed job. In preheating this cylinder charcoal was used in both the steam chest and the cylinder. Figs. 8 and 9 and Figs. 10 and 11 show two broken cylinders before and after welding.



REGO REGULATORS

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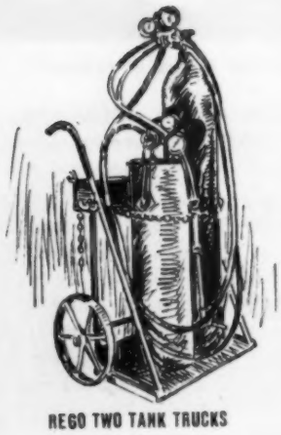

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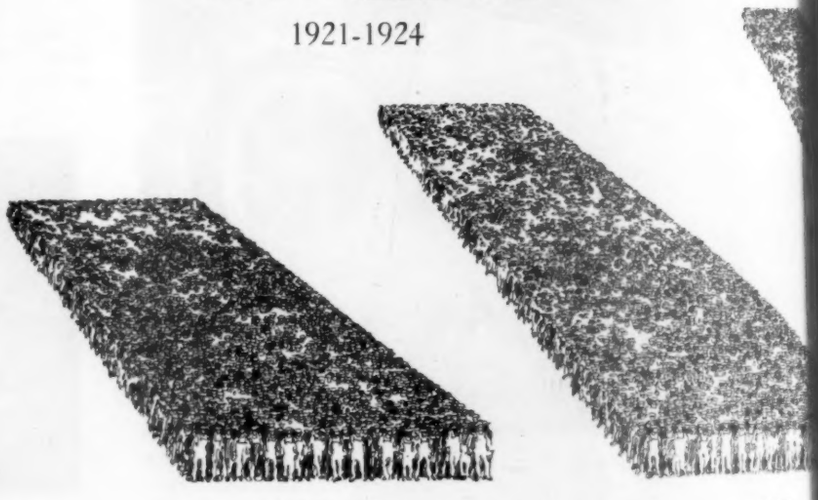

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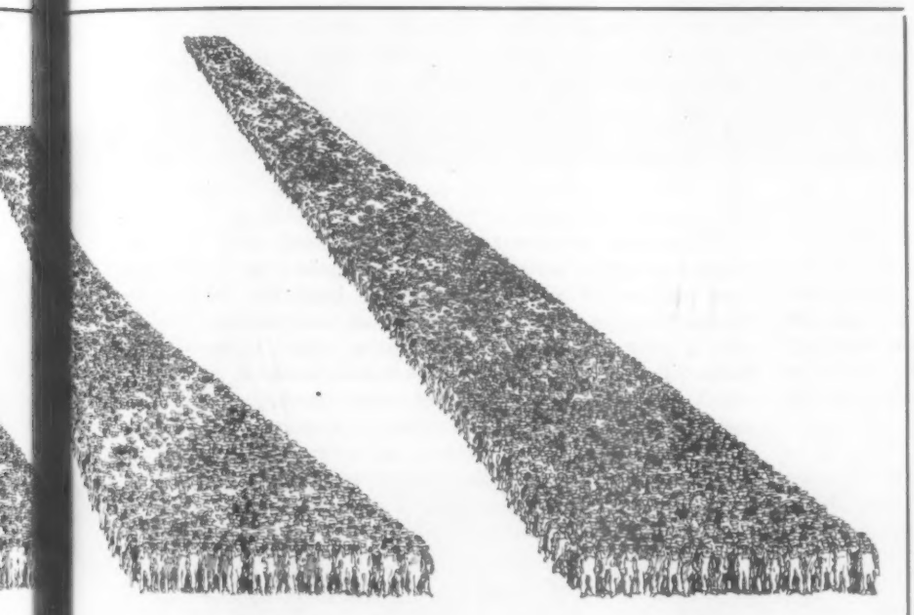

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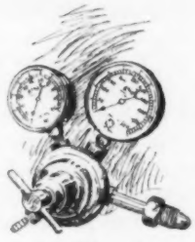

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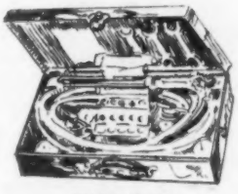


REGO OUTFITS

USING THE ARC WITH SAFETY

Methods of Protecting Eyes and Bodies of Electric Arc Welding Operators — Safeguarding Apparatus

By D. H. Deyoe†

FOR the protection of the operator and of men working in the near vicinity of electric welding and cutting operations, it is necessary to take certain precautions. If these precautions are taken, arc welding becomes a perfectly safe occupation. There are, at present, some 60,000 welders using the arc. We have several welders at our plant who have worked steadily with the arc for six or seven years without apparently bad effect. In ordinary arc welding, where currents ranging from 50 to 200 amperes only are used, simple precautions are necessary for the protection of the operator's eyes and the exposed portions of his body.

Protection of the Eyes and Body

The usual method of protecting eyes is the use of a face shield or head mask with glass window inserts, the glass of which is of such composition as to absorb the injurious ultra-violet and infra-red rays. When several welders are working in the same room, in addition to the use of face shields or head masks, colored glasses with side protection are worn to protect the eyes of each operator from the arcs of the others.

All exposed parts of the body are subject to a burning effect from the rays of the arc. This burning is similar to a sunburn and if the body is not protected by a covering of some kind it will cause the operator more or less discomfort or pain. The body is usually covered by ordinary close-woven clothing and the hands by leather gloves, not only to protect against the rays of the arc but against flying particles of hot metal. The gloves further protect him in handling hot parts. In heavy carbon arc welding and cutting, where currents from 200 to 1,000 amperes are used, it is necessary to protect the operator still further, as with these heavy currents the arc rays will penetrate the ordinary clothing and the flying particles of molten metal will burn through them. Usually, a large, well fitting leather or asbestos apron is used to protect as much of the body of the operator as possible.

For the protection of men working in the near vicinity of an arc welder, opaque screens should be placed between the arc and the workers, or better still, a booth should be built around the operator, thereby shutting off the arc rays from the surrounding part of the factory.

Welding Booths

Care has to be taken regarding the painting of the interior of an arc welding booth. If a paint that reflects the rays of an arc is used the operator may be subjected to eye flashes from the side and back of his face shield, or to the burning on the back of his neck or ears. A paint should be used on the interior of a booth and on all machinery located within it that will absorb the dangerous rays. A simple satisfactory paint for this use is composed of zinc oxide and oil which may be given any desired tint with lamp black.

Where heavy welding or cutting is being done and where galvanized iron or steel or materials that are oily are being welded, it is very desirable in safeguarding the health of the operator to provide ventilation ducts or fans to carry away the smoke fumes from the vicinity of the work.

In metallic arc welding where direct current is used with an open circuit voltage or from 40 to 60 volts and a welding voltage of 20, it is not necessary to pay much attention to the protection of the operator from an electric shock. With alternating current welding this is a little more serious as the operating voltage ranges from 100 volts up as high as 175. If the operator is not careful while changing electrodes this is liable to give him quite a shock. There is really, however, no way protect the operator against this voltage as he is in direct contact with one side of the circuit in handling his work and with the other side of the circuit in inserting his electrode material. He must, in turn, be careful not to get in contact with both at the same time. This same condition applies to resistance welders used for railway current. In this it is necessary for the operator to be very careful to keep free from grounds while changing electrodes. Welding resistors for use in railway welding are sometimes provided with a push button station under the control of the welder for opening a contactor in the welding circuit while changing electrodes. However, many welders object to carrying around this push button station and would rather take the extra precaution when changing electrodes.

In many installations where a large number of small articles are welded, particularly with the automatic welder, instead of building a booth around the operator to protect outside workers and instead of providing the operator with a mask or face shield, an inclosed cabinet is built around the operation itself, inserting in this cabinet a colored glass protective window through which the operator can watch the progress of the welding.

Where many welders are working on small work it is customary to build a series of small booths, the tops of which are open and extend above the operator's head, the front of the booths being supplied with the welding control apparatus and with a bench on which material to be welded is placed. The backs of the booths are protected with a series of curtains which are closed by the operators before starting to weld. This makes a very compact and satisfactory arrangement.

For the protection of welding apparatus safeguards, as applied to apparatus of similar nature, are used, such as circuit breakers, contactors, fuses, enclosed switches, enclosing boxes for control apparatus, insulated couplings, gear cases, insulated holders, etc.

Paper read at the joint Safety Conference of the Engineering Section, National Safety Council, and American Society of Safety Engineers, New York, January 22, 1924.

†*Power and Mining Department, General Electric Company.*

NEW TAPERED ELECTRODE

The Electric Arc Cutting and Welding Company, Newark, N. J., have recently developed and placed on the market a new type of welding electrode called the TAPEROD. This rod is designed to be gripped in the electrode holder by its larger end so that the smaller end may be used to start the arc. As the heat rises during the process of welding, it is claimed that the constant and uniform increase in the thickness of this rod will be found to provide heat compensation along its entire length. The makers point out that welding may proceed with absolute uniformity, without the necessity of changing to a heavier rod as the heat increases.

The advantage claimed for this rod is that its gradually increasing diameter allows a corresponding increase in deposition with a constant heat value in the work deposit. Moreover, the heating of the rod due to resistance loss is compensated for by the larger diameter of that part of the electrode which carries the current the longest, and waste ends are reduced to a minimum because the electrode does not become red hot as it gets short. Also the small end of the Taperod allows the welder to get properly started in narrow corners and reentrant spaces without losing the arc because the rod becomes red hot as the weld progresses.

WELDING AT AN ORE DOCK

How the Arc and the Torch Work Side by Side, Keeping Massive Machine Parts in Order

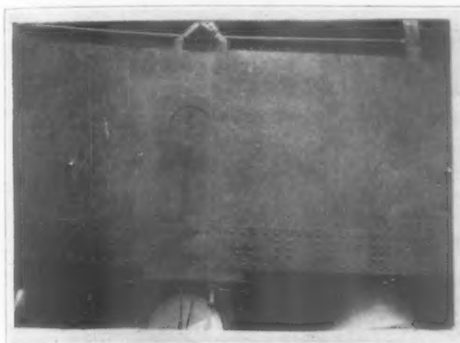
By R. K. Randall*

ON an inspection trip to one of the largest ore docks in the world I was interested to see how Electric and Acetylene Welding helped them to keep down replacement costs and save time on making repairs. For those who are not familiar with machinery used on ore docks I will say that only one word serves to describes the character of the machinery. That word is "Massive." Picture if you can great buckets holding half a carload of ore constantly going into the ships' hatches, filling themselves and on their return dumping their cargo into freight cars. After the ship is unloaded the refilling is perhaps more interesting, as in loading the coal for the return trip the coal car is literally picked up and turned upside down, dumping the coal into a chute which leads to the hatches. Machinery of this type, of course, naturally has to be very rugged and tough and for that reason parts are made up mostly of cast steel.

The buckets themselves are made of cast steel arms with rolled steel sides. The sides are laid out from a template on flat 1¼-inch steel, cut to size with an oxy-acetylene torch and then formed at the blacksmith shop. The cast steel sections of the bucket frequently wear and develop cracks, which are "Vee'd" out and then welded with the electric arc. The time spent in welding this is nothing as compared to cutting out rivets and installing new sections, to say nothing of the saving over the cost of new castings. Three or four buckets are used as spares and when one needs repairing it is just dropped from the lifter, another one put on, and the broken one welded while on the spare platform. In this way replacements are always available.

Another big saving has been effected through the welding of worn steel "Shives." These shives are built up with the electric arc process and then machined to size.

The heavy forged steel axles that support the mammoth loaders and unloaders wear on their bearing surfaces and these are also built up by electric welding and then machined to size. Before welding these axles a cut is taken off so as to be sure that the welded metal has a good clean surface for fusion. Worn wheels with flat spots are built up to size by the same method. One very interesting job I saw, was a smoke-tight "scale house."



Close-up of Scale House

Unloading Bucket

Welded Steel Casting

The house itself was built of steel and had all the seams electric welded, so that smoke from the engines which are passing beneath would not fill the scale house with smoke, dust and cinders.

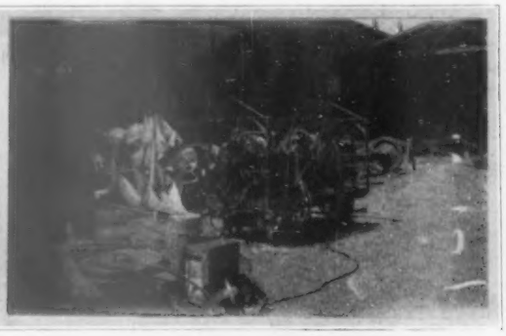
Ships coming in to load and unload often need repairs, both minor and major, and the electric welding machine is brought alongside, leads are thrown aboard and repairs quickly made. Small cast iron jobs are done with the oxy-acetylene torch, but the heavy cast iron work is done with the electric arc using studs. The machine used is of the portable type, with a canvas covering attached to the light steel frame, so that weather conditions do not interfere with outside work. It may be of interest to know that the "Welder" on the job is a graduate of a welding school and so far has had no failures. His initiative in suggesting the welding of many parts that formerly were consigned to the scrap heap has resulted in the saving of many dollars to the firm.

Another interesting thing is the fact that all jobs are dated, using the arc to "Write" on the date. In this way the actual wearing time of a welded job can be checked up to compare its life with a new part.

The accompanying pictures give a little idea of the work done.

Axle with Worn Bearing Built Up and Machined to Size

Scale House Made Smoke Tight by Welding



Portable Arc Welder Has Steel Frame for Canvas Covering to Be Used in Rainy Weather

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*Welding Instructor, Cleveland Y. M. C. A. School of Technology.

The Welding Engineer

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The Welding Encyclopedia

RECOGNITION of the authority and completeness of this book could be indicated in no better way than by the rapidity with which three editions have already been exhausted. It has put at the disposal of the welding industry the experiences of a select group of experts, who have been responsible for the continued progress made in the industry, and who have contributed generously from their accumulated knowledge in order that succeeding editions might not be lacking in any important detail. No effort has been spared in making the work of these men easily accessible to the supervisor, the welder, and the student. The courses in gas and electric welding include outlines of reading courses in which the work of selecting and arranging material for continuous reading has been carefully done. It is expected that the continued and wider distribution of the new editions will be a material aid in providing the industry with better informed operators.

Make Instruction a Specialty

WHENEVER conditions warrant such an arrangement it is desirable to have the instruction of welding apprentices in the hands of a man specially detailed for that purpose and chosen for his ability to teach the theory of the process. The young student is more apt to learn what he is doing and why he is doing it if his instructor is capable of presenting facts in an understandable fashion. After the preliminary instruction is finished is time enough for the foreman or supervisor to take a hand and demonstrate useful tricks and kinks from time to time, so that the educational process goes merrily on, indefinitely. But very often the foreman or supervisor can do a lot more than he can teach, in addition to being handicapped by numerous responsibilities which do not allow him to appear at his best as instructor.

Not an Accident

BEFORE the advent of a trade paper founded for the purpose of discussing exclusively welding subjects, not much attention was paid to "adding material" by the user. There were very few trademarked brands of rods or electrodes; and filler rods were ordered on a most haphazard basis, with corresponding results. Just as soon as a medium for spreading information about welding rods and electrodes became available the situation began to change. The products of various mills became known by name, and consumers gradually learned to insist upon particular brands, known to be uniform. Today no reputable dealer will sell filler material unless he is sure that it is both uniform and of good welding quality. This development of the demand for the right kind of filler material has been one of the most important reasons for the improvement in results during the past eight years. And it didn't just happen.

Charge Enough for the Small Job

STEADY customers are the delight of the job welding shop and every shop owner likes to cultivate them. Very often small jobs from transient customers are undercharged in the hope of developing a steady customer. It is easy to lose a lot of good profit by carrying such a practice too far. The steady customer is always a prospect on the list of some apparatus salesman, so there is always a chance of losing that business through no fault of the shop. On the other hand, the small jobs show a surprising total at the end of the month. Don't make any repair for the price of a package of cigarettes. It's worth more, both to you and to your customer.

PREST-O-LITE has its own cylinder factory in Indianapolis. Every other working day last year, this factory poured a carload of new cylinders into the service of Prest-O-Lite users, thus demonstrating the important part Prest-O-Lite service plays in the expanding use of the oxy-acetylene process.

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Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way – I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today – the men on the firing line are waiting. L. B. Mackenzie, Editor.

LOCOMOTIVE CYLINDER WELDED WITH TOBIN BRONZE

By E. R. Lindsey

The accompanying photographs show quite an interesting locomotive cylinder repair job, which was accomplished in an economical manner by welding with Tobin Bronze. This cylinder was repaired in a place as shown.

Photo No. 1 shows the cylinder prepared ready for preheating, with a suspended sheet iron pan holding pulverized asbestos up against the lower portion of the cylinder. Slabs of asbestos

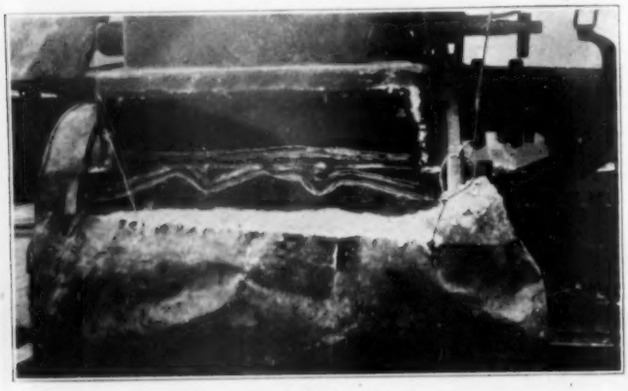


Fig. 1—Ready for Preheating

were laid over the upper portion. This cylinder had two breaks as the photo shows, the lower zig-zag crack extending full length of cylinder barrel through both front and rear flanges. Just above this was another straight crack extending to within about 4 inches of flange on each end and joined to lower crack at two points. Both cracks were bevelled out to form a vee with about $\frac{3}{16}$" gap at bottom of vee.

The cylinder was preheated (using natural gas) to about the heat required in expanding for inserting bushing. Two welders were then started, one at each end and worked towards the centre. The gas preheating flame was kept going inside the cylinder all through the job. As soon as the welders finished the heavy section of the flange and about 6 or 8 inches along the lower crack they started the upper crack, and from then on alternated from one crack to the other, carrying both along about even. The last 10 or 12 inches of centre was finished by one welder. Asbestos was then packed in over the weld, the gas heating flame removed from inside and cylinder allowed to slowly cool.

Photo No. 2 was taken after a water test of 190 lbs. had been applied. Two pin hole leaks were stopped by peening the bronze. The actual welding required 2 hours with 2 welders, 15 lbs. of Tobin Bronze being used and approximately 160 cu. ft. of Oxygen and 150 cu. ft. of Acetylene. The same job if done with cast iron would have required twice the length of time. The saving in gases used and welder hours make the bronze method much more economical. The cylinder does not require heating to as high a temperature as for cast iron welding, hence there is less expansion and contraction to be accounted for.

As to strength of bronze weld on cast iron the writer has made numerous tensile and other tests sufficient to prove that bronze properly applied will pull out the cast iron. Thus on test bars one really gets only the tensile strength of the cast iron. By welding pieces of cast iron having a tensile strength as high as

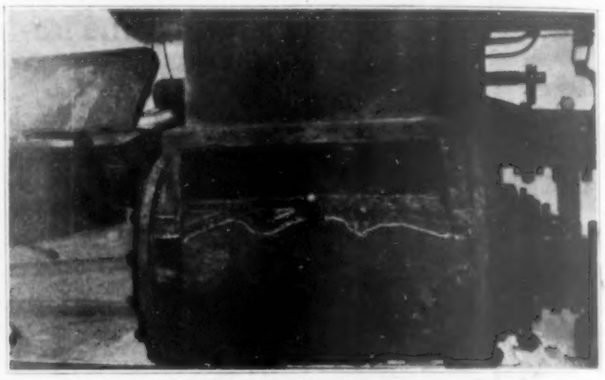


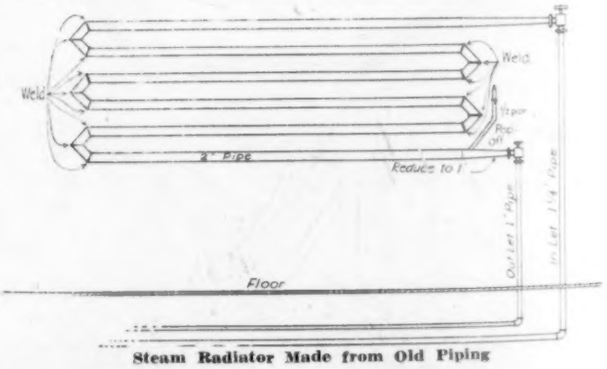
Fig. 2—After the Water Test

33,000, with tobin bronze and machining the bronze off to even dimension with the bar breaks occured well away from the bevel faces to which bronze was applied. A number of tests ranging from 24,000 to 33,400 were made, breaks accuring ½ to 3 inches away from the bronze. A special flux for brazing cast iron should be used.

ALL-WELDED HEATING SYSTEM

By Irving Pyle

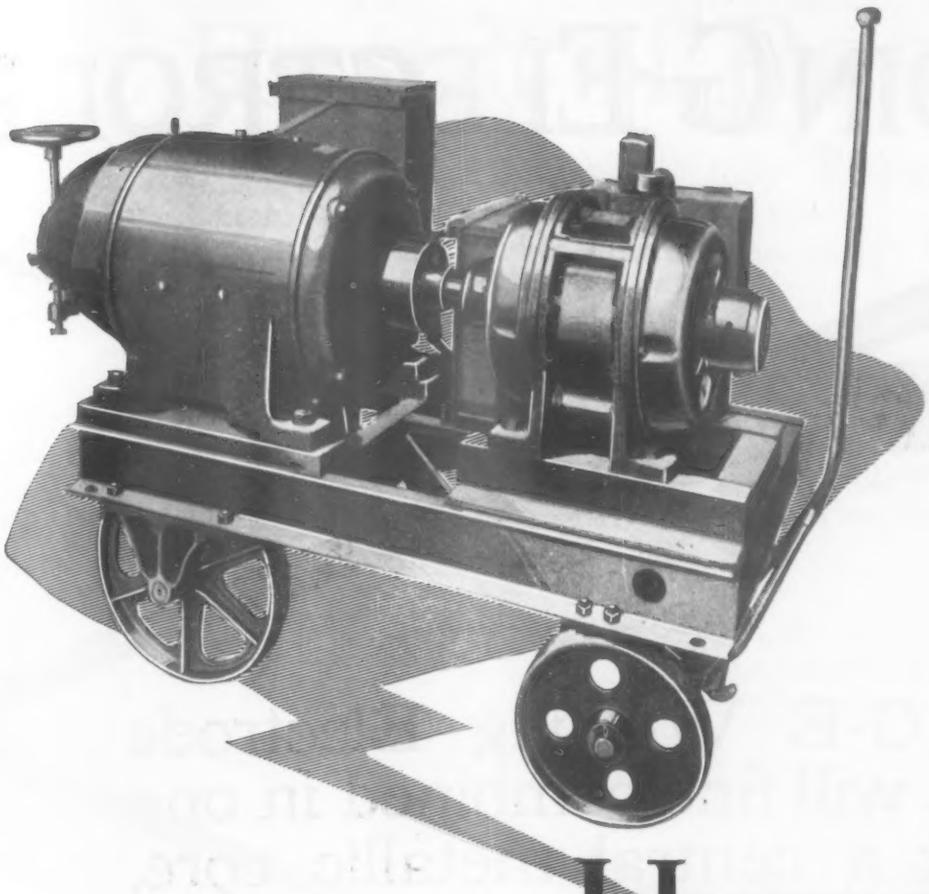
It is possible to construct a thoroughly satisfactory steam heating system with all welded joints, and the assembly can be



Steam Radiator Made from Old Piping

made so neatly that it presents a very good appearance when painted. The only joints in the heating system shown in the sketch which were not welded are the valves. A 1¼-inch inlet valve and a 1-inch outlet valve are used. The coils are of 2-inch pipe and have been reduced as indicated to fit the coupling. This heating coil was installed with the inlet and outlet pipes running under the floor, not touching the wood. It is a very satisfactory type of radiator.

(*Continued on page* 36)



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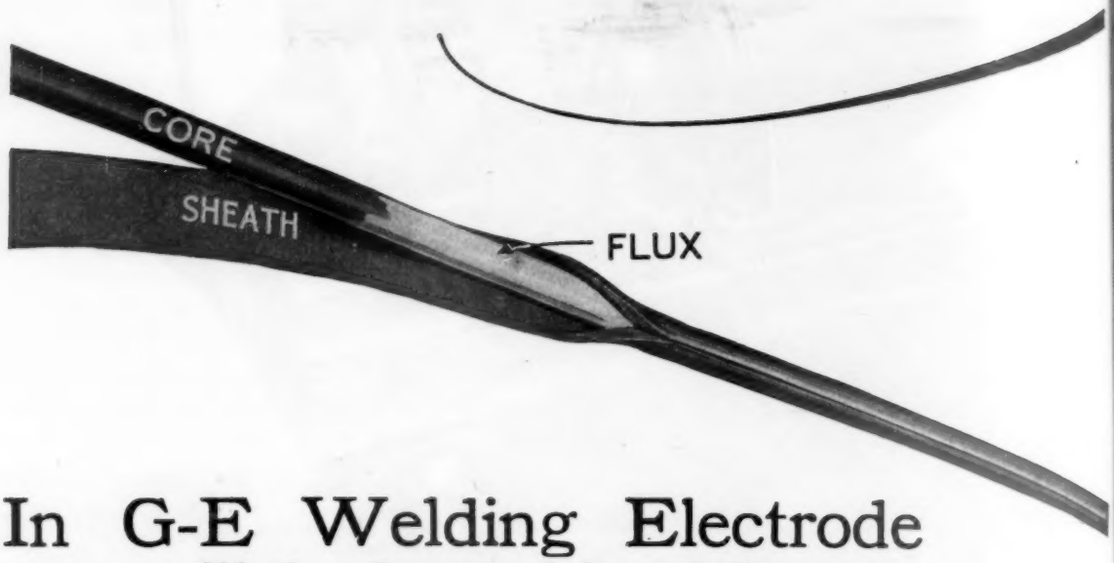

In G-E Welding Electrode you will find combined in one unit a central metallic core, surrounded by a layer of flux, all enclosed in an outer metallic sheath.

The sheath prevents flaking off of the flux—and it precludes the dissipation of the flux before the actual melting down of the metallic elements.

The flux contains ingredients which assure superior arcing characteristics, ductility of deposited metal, and other desirable results.

Distributors listed carry G-E Welding Electrode in stock. One trial will convince you of its worth.

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Merchandise Department
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GENERAL

The Result of Research

G-E Welding Electrode is fully developed.
Extensive actual service has proved that it

readily welds cast iron with a machinable weld
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assures exceptionally easy manipulation
localizes heat at the spot required
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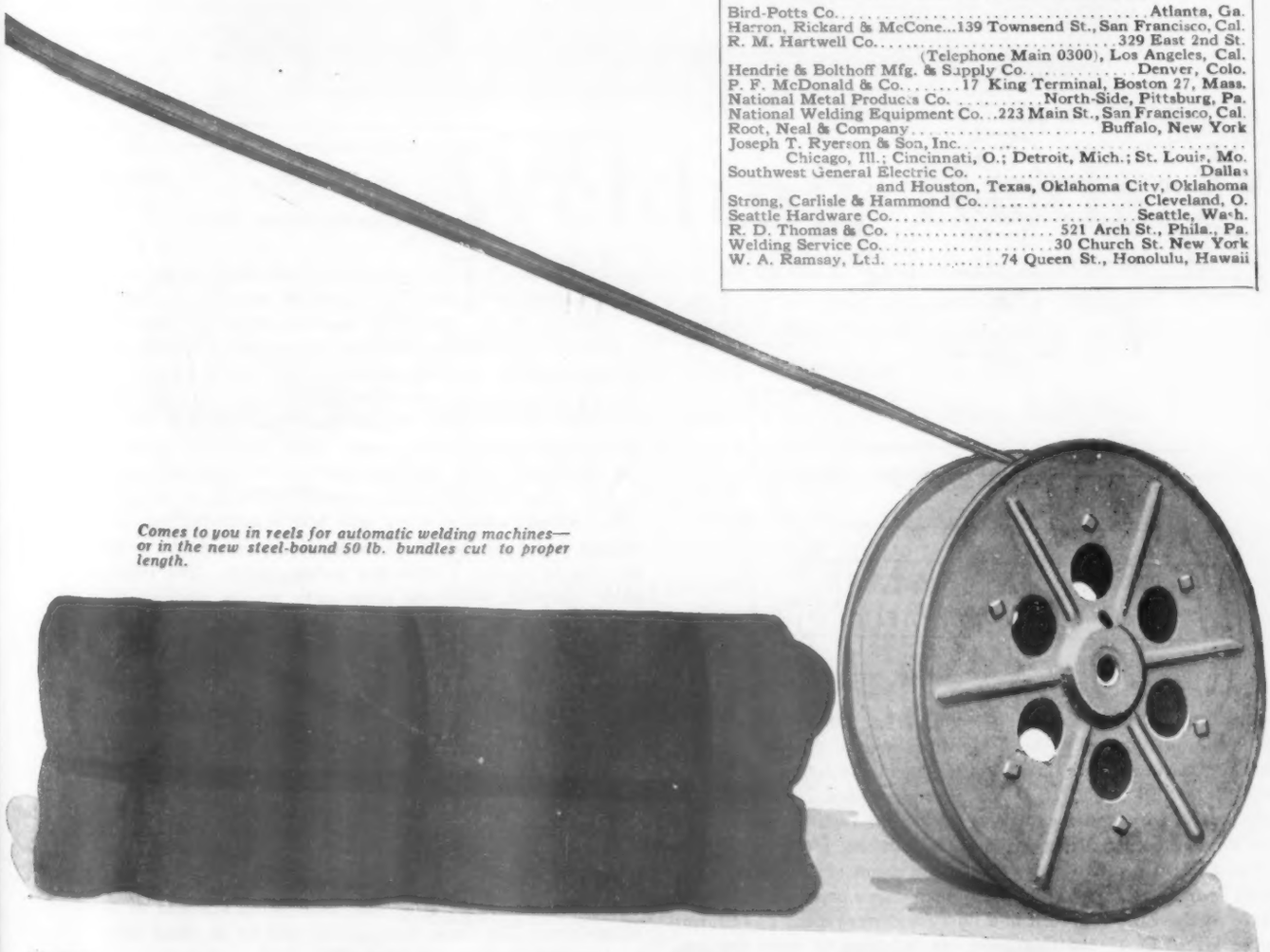

Comes to you in reels for automatic welding machines—or in the new steel-bound 50 lb. bundles cut to proper length.

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HINTS FOR THE WELDER

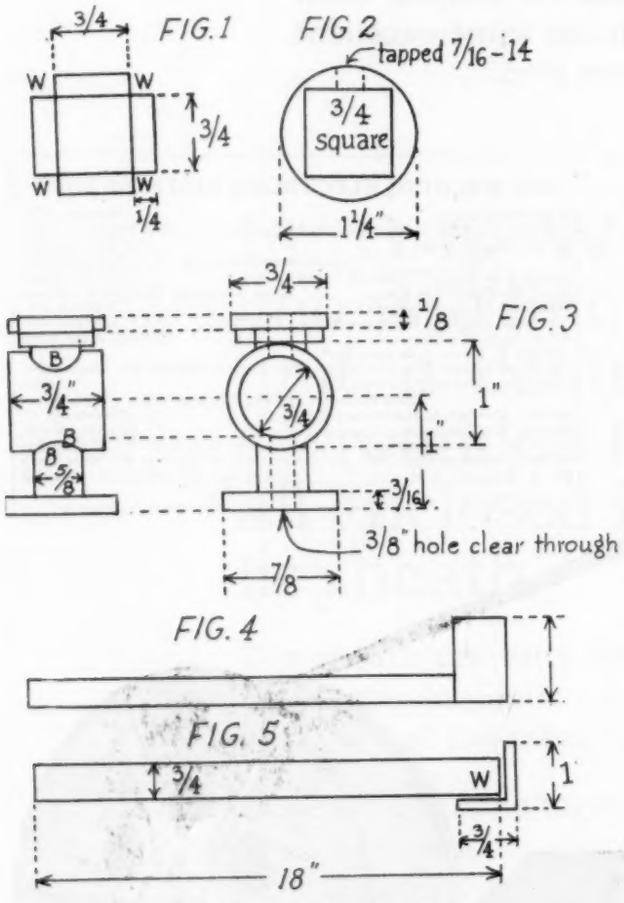
(*Continued from page 32*)

VARIETY OF JOB SHOP WORK

By Edwin Kilburn

The Jobbing, Machine, and Repair shop worker is called upon to perform many unusual jobs, on some of which the welding torch makes easy what would otherwise be a tedious and expensive piece of work.

The accompanying sketches illustrate some of the work we have recently done. We desired to use a large expansion reamer in a machine, the spindle of which had a straight bore socket 1¼" diameter and the reamer a ¾" square shank. In order to adapt the machine to the reamer it was necessary to provide a socket, round on the outside, and with a ¾" square opening in the center. The socket was made as follows: Four pieces of ¼x¾ steel 1" long were arranged as shown in Fig. 1, a piece of carbon block ¾" square being placed in the center opening. The corners were welded as shown at W. After cooling the square opening was finished to fit the reamer shank, then the reamer with socket mounted upon it was placed in the lathe and outside finished to 1¼" diameter to fit machine socket. This made a very satisfactory and inexpensive socket, in fact, we believe the cost to have been considerably less than making from the solid.



Odd Jobs in Arc Welding Shop

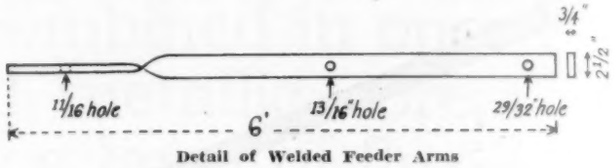
Fig. 3 illustrates two views of a white metal (or die cast) piece which is used as part of the valve gear on an orphan automobile. Three of these were needed in a hurry and were made as follows: Three pieces of 1" shafting were cut ¾" long to form the central body part, a ¾" hole being bored through center of piece to make central opening shown. Then three pieces of shafting were turned to make bottom portion which is ⅞" diam. with a ⅝" diameter part reaching to central body. The top portion was made from three pieces of ¾" shafting, being made like a washer ⅛" thick. These top and bottom pieces had holes ⅜" diam. drilled centrally through them and a ⅜" hole was drilled across the central body portions as shown. To correspond to the openings in top and bottom pieces, the three pieces comprising each set were then mounted upon a piece of carbon rod, the joints shown at B B brazed, and thus the casting replacement pieces were produced at a very reasonable expense, for all practical purposes better than the original and in a short time.

Figs. 4 and 5 illustrate a bolt driver which was made for an unusual situation and which illustrates how welding will often save considerable time. It became necessary to remove a spring shackle bolt from an automobile, the bolt being located beside the splashboard, in line with the running board and only a little more than an inch from it. No opening in the splash board was provided for driving out the bolt so in order to reach it, it became necessary to make a driver which would pass beneath the running board and reach up far enough to come in contact with the end of the bolt. A piece of ¾" mild steel rod 18" long and a piece of ¾" by 1" angle steel 2" long and welded together as shown in Fig. 5 made a very satisfactory driver and also an inexpensive one.

WELDING ORE FEEDER ARMS

By George Reed

A few months ago one of the writers in *The Welding Engineer* spoke of packing a weld by the use of a machinist hand hammer. For several years I have both advocated and practised this method on steel welds whenever convenience and the location of the weld made it possible. This forging process however should not be practised on cast iron welds because in so doing the iron is packed to such a density that it will not stand shocks or vibration without causing the metal to crystalize and often to break.



Detail of Welded Feeder Arms

Referring to the steel weld again I remember some years ago a number of ore feeder arms had become worn at the holes shown in this diagram. It was desired to have these holes filled up by electric welding and then redrilled to correct size. Unfortunately the work was not done well the first time. In fact the following two serious mistakes were made. First the feeder arms were laid flat side down on an ice cold cast iron welding table in January so that when the hot metal touched this slab, it shrunk immediately, causing what molders call "cold shot." Second, too high a voltage was used and we failed to place a sheet of asbestos under the arm to protect it from the welding table. The result of this work was that when the arms came to the machine shop they were found to be difficult to drill as they were hard and contained a number of holes. Only a few of them were drilled before it was decided to heat each weld in a blacksmith's forge to a white heat and then pound the weld as recommended by your correspondent. The result was all that could be desired. Since then I have witnessed many similar instances where packing or pounding has improved the condition of the weld.

Announcement is made of the incorporation of the Siemund Marine Electric Welding Company, 29 Broadway, New York, with $600,000 capital stock. The incorporated company will continue the operations of the long time established business of repairing steamships. The same management will be in effect with Henry L. Siemund heading the company.

A general contract has been awarded to the Pamfilis Contracting Company by the Autogenous Welding and Machine Company, 1217 Maryland Avenue, Baltimore, for the erection of a one-story top addition to the present building. This will be 84x98 ft., and the estimated cost is $27,000.

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No matter what welding process you use—

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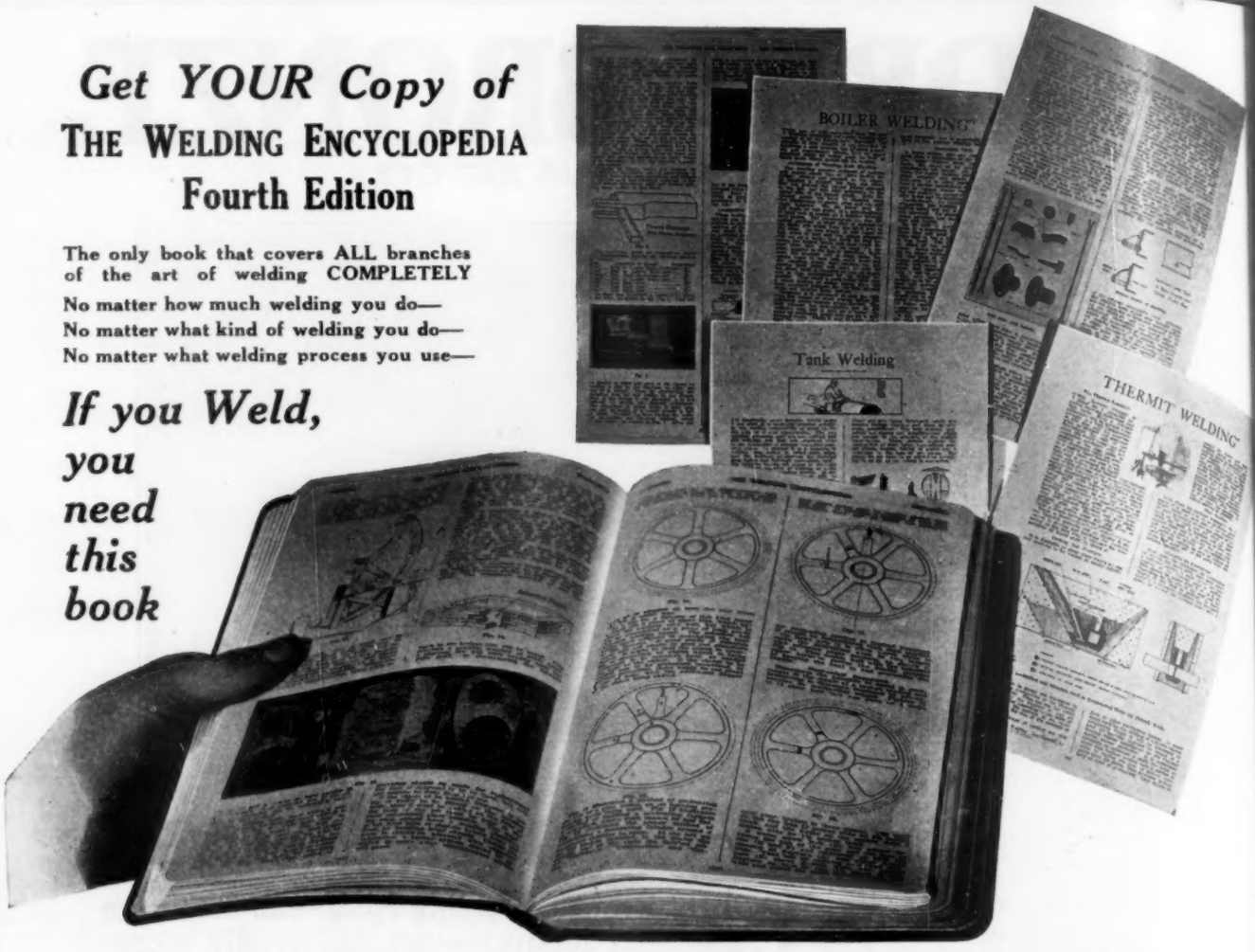


THE WELDING ENCYCLOPEDIA, Fourth Edition
COMPLETE—UP-TO-DATE—AUTHENTIC,
Expert advice at your finger tips

It serves every possible need for information on all of the welding processes. Whether your shop is engaged in production welding or repair welding, or both, whether you use the processes for only one metal or for a variety of different metals and different types of joints, **The Welding Encyclopedia** furnishes you with expert advice which pays for itself by increasing the quality of your work. **The Welding Encyclopedia** is not restricted to the welding knowledge that can be imparted by a single writer. On the contrary, each subject is discussed by a recognized authority on that particular subject. About fifty of the best known authorities on welding subjects in the world have contributed the results of their experience and research along special lines.

In compiling **The Welding Encyclopedia** the editors have had put at their disposal a vast fund of information which could not be made available through any other source. The result is a single volume covering the entire range of problems which can arise in the application of any of the welding processes, and this information has been so carefully arranged and cross-indexed that any portion of it is instantly located.

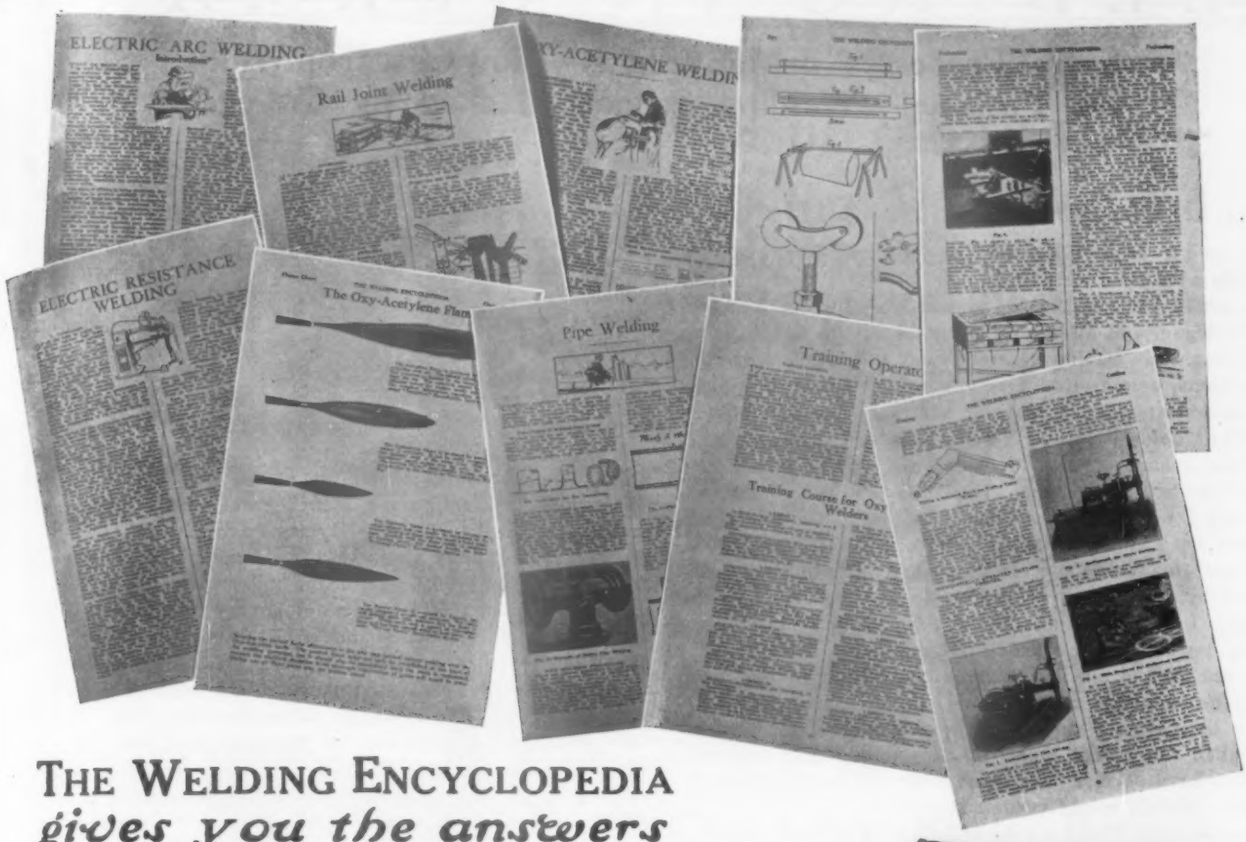
The Welding Encyclopedia describes in detail the theory and practice of every welding process, and tells how to weld every weldable metal by each of these processes, giving detailed instructions for handling such important welding jobs as boiler welding, sheet metal welding, tank welding, pipe welding, automobile welding, cutting, rail joint welding, railroad welding, etc.

It tells how to prepare parts for welding, how to preheat, how to anneal, how to test welds and how to select welding material. It explains the meaning of all words and terms found in welding literature. It gives the trade names of all products used in the welding industry, giving the name and address of the manufacturer in each case.

It tells how to take care of welding equipment so as to get the best results from it and keep maintenance costs down. It gives the latest revised federal, state and insurance rules and regulations for the installation of welding equipment, and its application to important work. There is also a splendid collection of charts and tables used for welding information, grouped together for convenient reference.

A valuable feature of The Welding Encyclopedia is the chapter on the training of operators. This chapter outlines lessons, exercises and examinations for a complete course in both oxy-acetylene and electric arc welding. Throughout these instruction courses references are supplied to the instructor and student so that they may find instantly the portions of the text which cover the topics in the outline.

The text is profusely illustrated with photographs and drawings made especially for **The Welding Encyclopedia.** No detail has been overlooked which could make **The Welding Encyclopedia** complete and practical.



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gives you the answers

The editorial office of **The Welding Engineer** is recognized as the headquarters for authoritative information and help on all branches of welding, and conducts a large volume of correspondence helping welders and welding departments out of their difficulties. In a period of eight months it was found that 95% of the problems submitted to this office were answered directly from the pages of **The Welding Encyclopedia.**

Think of the time all these welders would have saved by providing themselves with a copy of **The Welding Encyclopedia** in advance! **Don't wait** until you get into trouble, or run up against a hard welding problem, but get the information in your hands **now.** Then, when you want it, it will be instantly available.

Whatever your troubles may be, you will find that **The Welding Encyclopedia** furnishes expert advice and instruction.

The table of contents below can give you only a very general idea of the scope of this work. Send for the book and give it a careful examination. We guarantee that it will be fully satisfactory and if not we will cheerfully make a refund. **Send the coupon today.**

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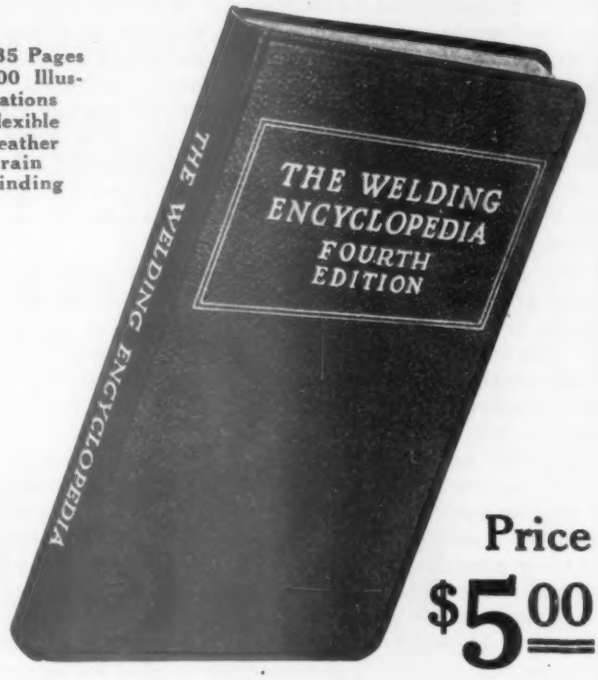

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3. Electric Arc Welding.—Complete instructions for welding all metals, studding, cutting, etc.
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Welding Engineer Publishing Co.,
608 S. Dearborn St., Chicago, Ill.

Please send me a copy of The Welding Encyclopedia, Fourth Edition, for which find enclosed five dollars. I understand that I may keep it for five days for examination and if it is not satisfactory I may return it and you will refund the purchase price.

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WELDING IN GERMANY

"Secret Processes" in Many Shops—How Cast Iron Welds Are Finished—Welding Schools Backed by Colleges

Berlin, Germany.
Wednesday.

Dear Ed:

Well, here I be in Germany. My experiences in getting from Italy over here were such that I won't forget them in a long while. If you could conceive of Illinois, Indiana, Ohio, Michigan, and all the other States of the Union being different countries, having different rules and regulations covering customs, immigration, etc., you would then be in a position to appreciate what a traveler has to go through now-a-days, when "doing" Europe. When I turned into my berth I had fond visions of a good night's sleep for I was weary and tired as they make them. Did I sleep? Yes, about two hours, then I was rudely awakened. At first I thought there must have been an accident, for the train had stopped and I could hear many people talking and shouting outside. Prompted by curiosity I donned a few clothes and went to the door. Immediately an officer approached and directed me along a platform to a group of men whom I learned directly, were custom officials of some country or another, and I had to be in on the ceremony. Then we were paraded up ahead to the baggage car. Did those officials enter the car and examine our things there? They emphatically did not! We had to have porters drag everything out on the platform before the officials would even look at it.

Being very sleepy, you can imagine just how cheery a stunt of this kind would make a fellow feel. However, in a short time the train was again in motion and we cussed ourselves to sleep. Now it seemed about fifteen minutes, but in reality it was a little more than two hours when we reached the boundary of another country and had the same thing perpetrated upon us. The temptation, of course, was to get sore, but on second thought it was realized that this was just one of the little peculiarities to be found when traveling in foreign lands.

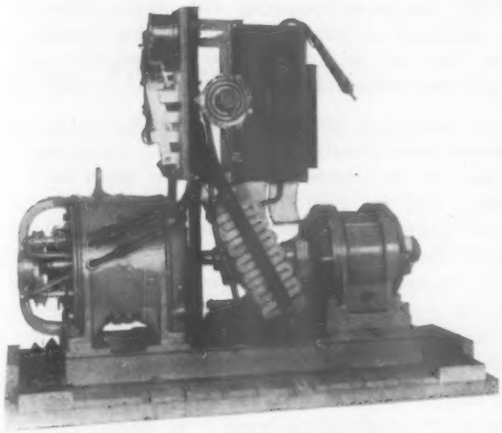
In due season Germany was reached and I have been knocking around for about three weeks. In my travels thus far Berlin is the most Americanized city I have yet encountered. The streets are wide, the buildings well planned, lots of people on the streets, and signs of action everywhere. If people are suffering from the aftermath of the war, it is not apparent to the traveler.

So far as the welding apparatus is concerned, it is much the same type as that I had seen in other countries; practically all of the low pressure type. There is an abundance of small portable low pressure acetylene generators. The manufacturers of these generators, as well as the rest of the equipment, do not seem to pay as much attention to the appearance of their equipment as the Americans. If they wish tubes to convey gases the length of the torch or the generator, it seems to make no difference to them whether these tubes are on the outside, exposed to the eye, rather than on the inside, concealed. At first glance this equipment appears very complicated but no doubt the manufacturers have perfectly good reasons for following the designs they have. About ninety per cent of the apparatus manufactured in Germany is made along the Rhine, in that part called the Ruhr district.

Up until the present time, although I have visited a large number of welding shops and establishments where welding was carried on, I have not come in contact with anything that is really exceptional, except possibly "Secret Processes." At first after calling at one or two different places, I thought nothing about the fact that they claimed an exclusive method, only known to themselves, for doing certain classes of work. But after calling on other places and finding that in each instance I was being told in the strictest confidence that they were doing certain classes of their work with a secret process, it did not carry quite so much weight. In one place one man would have a process, known only to himself, for welding copper. In another place a certain kind of flux was employed to eliminate blowholes and hard spots in cast iron. In yet another place the alloyed steels were being handled in a similar fashion. And so it was all along the line. The amusing part of it was that in each case I was informed that they would be glad to place me in possession of their secret, providing a certain consideration in the way of cash money, was made. I hardly knew how to take this, whether as a compliment or the reverse. It may have been that I looked prosperous and they thought I had money; or was it my "green" looks? I'll let you be the judge.

When I stated that I saw nothing very outstanding in the welding line, I intended to make one exception. There was one shop I visited where they were doing a great deal of cast iron welding. Most of this work was being done on new castings. They were evidently salvaging them. The method they employed of dressing the weld while it was still hot was about the cleverest thing I have ever seen done in the welding line. I have seen the same thing attempted in other places, in fact, there were several shops in the States trying to finish their work in this manner, but they certainly did not have the process down to a finished basis like in this particular shop. The welds were made in the usual manner, but after the required amount of metal had been added, the welders picked up a heavy rasp file which they warmed slightly and then proceeded to dress down the weld, by alternating the application of the welding flame and the file until the proper finish had been obtained. The file had a tendency to fill up with the hot metal, but this was cleaned by wrapping it a smart blow on another casting. The weld, after being treated in this manner, carried the same appearance as the rest of the casting. A stunt of this kind is a mighty good thing for welders in job shops where a good looking piece of work will command a little higher price.

I have been handicapped much more than I anticipated by not knowing more of the German language. However, I have been able to get some interesting information relative to the educational work done along the welding line. We are all tempted to look upon the welding industry as being a comparatively young one. At best, when speaking of its commercial application, it is not over twenty years old. So far as I know there are only one or two schools of any repute offering welding instruction at the present time in the States, and in such instances, the method of training is not based on any well developed system. You can well imagine my surprise to learn that as far back as 1911 there were fourteen well organized welding schools offering welding instruction in Germany, and that three years later, namely, 1914, this number was increased to sixty-one. Most of these schools were organized and operated in conjunction with colleges. The courses of instruction were exceedingly well worked out to gain the greatest efficiency and cover the ground in the shortest possible time. It is quite true that the majority of this work was given with the idea of specializing on small parts, rather than on heavy work, but nevertheless, this training did take place and indicates that Germany appreciated the true value of educational work along this line. It would seem to me that it was high time that



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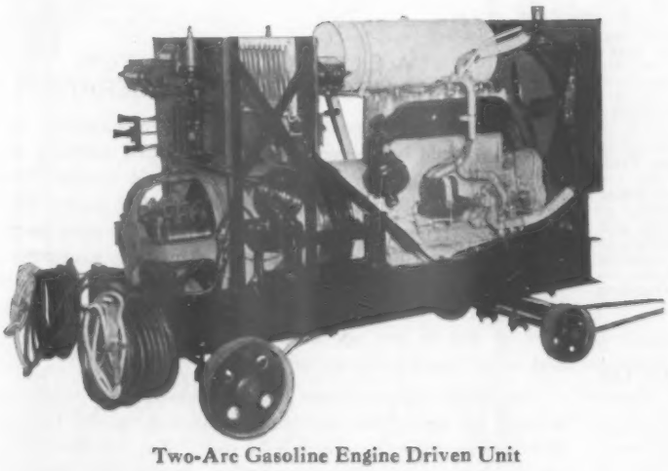
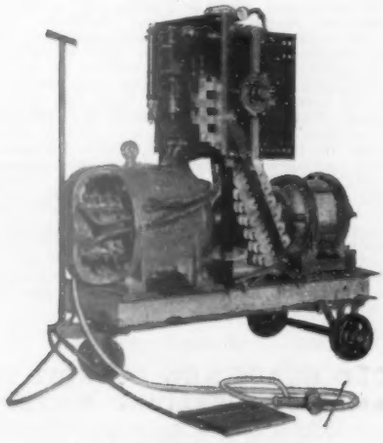


Two-Arc Gasoline Engine Driven Unit



Single Arc Portable Unit

those interested in the advancement of welding in our country should recognize the all-important part that the human element plays in welding and leave no stone unturned until this factor was given the consideration it deserves.

It was a man by the name of Kautny who was largely responsible for the educational progress made over here. I was very disappointed in not being able to meet him, but it so happens that he is now living in Switzerland. It looks as if I would have to wait until another time to see him, as I am very anxious to get over to England and see how they go after things there. I can't say that I have enjoyed my sojourn in Germany. This is no reflection on the country or the people, but simply on account of the embarrassing situations which arise with the currency they use for exchange. Picture yourself going into a cafe or hotel for lunch and enjoying a perfectly good meal only to learn that upon presentation of the check and payment thereof, that it will be necessary to accept as change two or three hundred million marks. They make this just as large a collection as possible, apparently to embarrass the traveler, and make him say, "Keep the change." As you appreciate its not the easiest thing in the world to carry a trunk load of these paper marks around with you and at the same time you cannot help but feel that something is being slipped over on you in instances of this kind. If I were to advise any one coming to this country as to the best means of meeting this proposition, I would tell him to load up with American dollars and then everything would be fine. By the way, it will interest you to learn that these same dollars together with the British Pound are gaining great favor with the Germans and they much prefer to receive than to give them.

I am going to ring off now, Ed, but before so doing I want to make a request. If any of the boys from the big town get down your way, or you should be up seeing the sights, I wish you would do all you could towards spreading the gospel and see if we cannot prevail upon the powers that be to develop the educational side of this big industry of ours in the States, to the same extent, if not better than it has been in some of the foreign countries.

As ever,

SHEP.

BOOK REVIEW

THE WELDING ENCYCLOPEDIA, Fourth Edition, published by The Welding Engineer Publishing Company, 608 S. Dearborn Street, Chicago, 435 pages, 600 illustrations, flexible leather grain binding —price $5.00. The first part of this book consists of definitions and discussions of words and terms commonly used in the welding industry, with instructions for making a great variety of welds and for performing a number of important operations supplementary to ordinary welding procedure. Many of the discussions in this section, which is arranged alphabetically, are written by men who have made special researches in the subjects covered. Special chapters are devoted to gas, arc, resistance and thermit welding, also to boiler welding, tank welding, pipe welding and rail joint welding. A valuable feature of this edition is the chapter on the training of operators. This chapter outlines lessons, exercises and examinations for complete courses in both oxy-acetylene and electric arc welding. Throughout these courses references are supplied to the reader so that portions of the text which cover the topics in the outline may be instantly located. The discussion is profusely illustrated with photographs and drawings made especially for THE WELDING ENCYCLOPEDIA, including color charts showing the color of metals at different temperatures and the proper method of adjusting the oxy-acetylene torch flame. The Catalog Section at the end displays and describes the standard makes of apparatus and supplies. A single volume is thus made to cover the entire range of problems which can arise in the application of any of the welding processes. Each subject is discussed by a recognized authority on that particular work. It serves every possible need for information on all of the welding processes.

H. M. GOULD HEADS NEW DETROIT SECTION OF AMERICAN WELDING SOCIETY

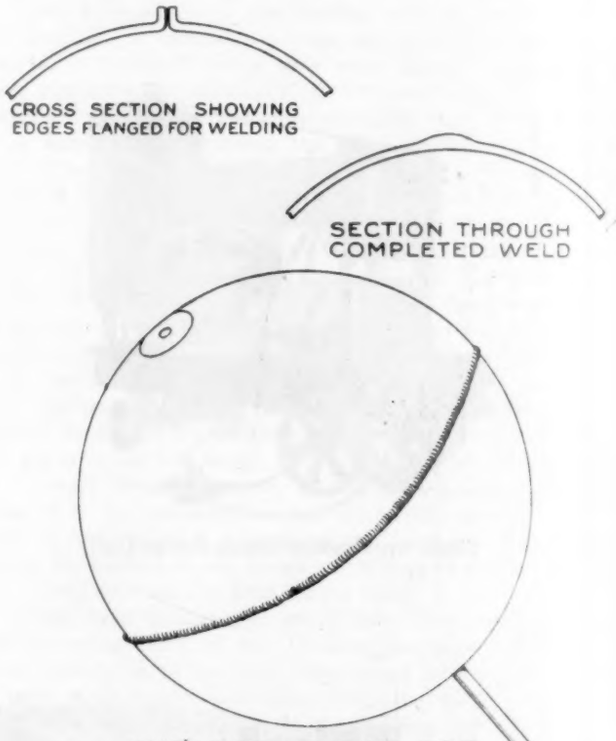
A new local section of the American Welding Society has just been organized at Detroit, Michigan. Mr. H. M. Gould, Electrical Engineer, Department of Street Railways, City of Detroit, who was the prime instigator and hard worker in the establishment of this section, was elected temporary chairman at the preliminary meeting recently held.

WELDING VERSUS SILVER-SOLDERING

Often the superintendent of a metal shop—either an independent shop or an integral part of a factory—becomes dissatisfied with his fabricating equipment, or realizes that his old equipment is preventing him from competing with others, either in quality or price. Methods of joining may be causing trouble. In getting the best way out, the advice of an oxy-acetylene service man or engineer often proves valuable.

As an instance, a certain concern manufacturing automatic refrigerators were already using the oxy-acetylene process to fabricate units of the ammonia system. The tanks were welded but the floats and the connections to tanks and coils were silver soldered. Due to the length of joint and consequently the comparatively large quantity of solder used, this method was proving very expensive. So another way of accomplishing the same result and one employing the oxy-acetylene process, was deemed necessary. The refrigerator manufacturer sought the advice of an oxy-acetylene service engineer.

The floats in question were 2⅝ in. in diameter, made up of two hemispherical sections spun from 25 gauge steel, the edge of one section being slightly crimped so as to telescope with the other. It was at this joint that the silver solder was applied.



WELDED FLOAT FOR AUTOMATIC REFRIGERATORS

The engineer suggested that if the hemispherical sections of the floats could be pressed with edges flanged outward, they might then be held together in a jig which would revolve them slowly and the edges could then be fused together under the heat of the oxy-acetylene flame. The manufacturer accordingly had a number of sections made up in the manner suggested and the engineer welded several sample floats. After completion the spheres were tested by subjecting them to an internal air pressure of 100 lb. per sq. in. while submerged in a tank of water, and were found to be air tight.

The plant officials were highly pleased with the results and decided to adopt this method of fabricating the floats, thereby eliminating expensive silver soldering. But for the timely advice of the oxy-acetylene engineer they might not otherwise have found it possible to make this improvement so promptly and so effectively.

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The above quotation from a letter received a very short while ago tells the result of a test which was run at the shop of one of the large railroads.

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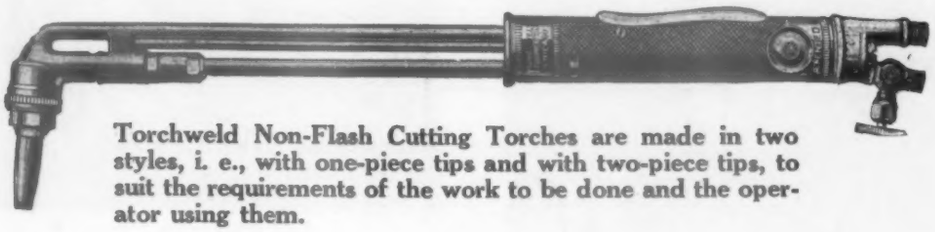

Torchweld Non-Flash Cutting Torches are made in two styles, i. e., with one-piece tips and with two-piece tips, to suit the requirements of the work to be done and the operator using them.

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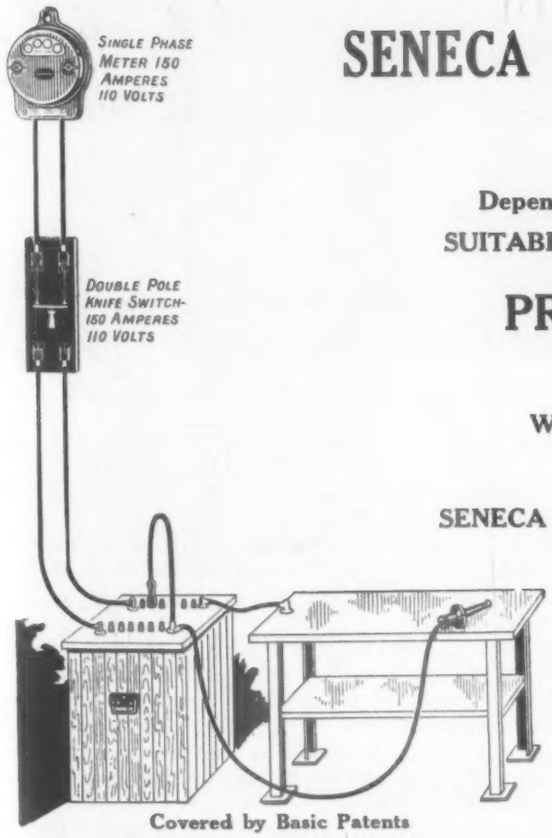

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Engine Ready for Service. Chalk Marks Show a Few of the Welds in Saddle

bits, everyone pronounced her a dead loss—that is, everyone but General Foreman, George F. Callahan.

George is one of those optimistic, constructive fellows who look on the world through rose-colored welding goggles, and so, after everyone else (including the other railway shops in Denver) had refused to undertake the task of reclaiming "390" and had

Sid Gregory, Welding Engineer at D. & L. Shops. Preheating Furnaces in Course of Construction

declared it to be not only impracticable but impossible, George merely scratched his head, smiled in his usual cheerful way and said, "Well boys, I can't see why we should shoot this perfectly good horse just because her saddle's busted."

It was a plain case of "save the saddle and you save all," but it was work that would have discouraged Hercules himself and so everybody said, "Let George do it!"

George did it and "390" is today proudly pounding her eight

Pattern Maker with Completed Patterns of Lost Cylinder Saddle Pieces

big drive wheels over the rails in regular daily passenger service, better than ever; the Denver and Salt Lake Railway is "in" the price of a new engine; and George F. Callahan is hailed as a Miracle Man of Shop Surgery.

The cylinder saddle welded was broken all the way from the live steam channel to the exhaust channel and through the cylin-

Welding One Side of Saddle After Preheating

der walls. The total length of the saddle crack was approximately twenty-six feet; its thickness was from 2½ to 4 inches; and the total quantity of welding-rod used was approximately 400 pounds.

Sid Gregory, welding engineer at the Moffat shops, built a preheating furance around the cracked cylinder saddle and accomplished his part of the work with such success as only a master craftsman can attain.

The pattern maker provided patterns for the lost cylinder pieces and the whole outfit worked together in harmony for the good of the road until the work was satisfactorily completed.

Such tremendous tasks as this, successfully performed, show that good men, plus good torches and good gas, can make the wheels of industry spin again, when, like "390's," they have apparently stopped forever.

And George Callahan's Slogan "It can be done," should hold inspiration for welding shops everywhere.

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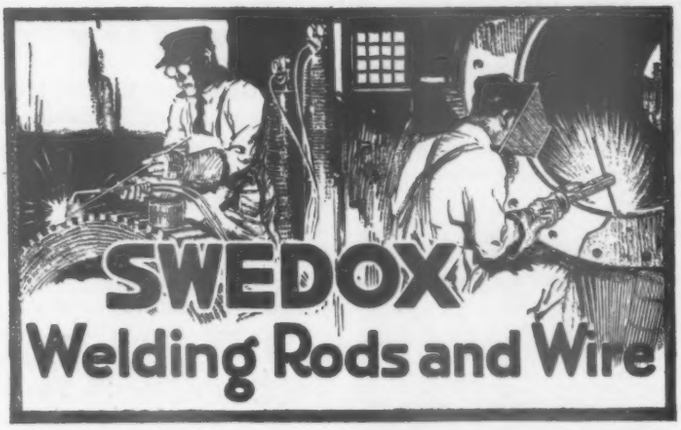

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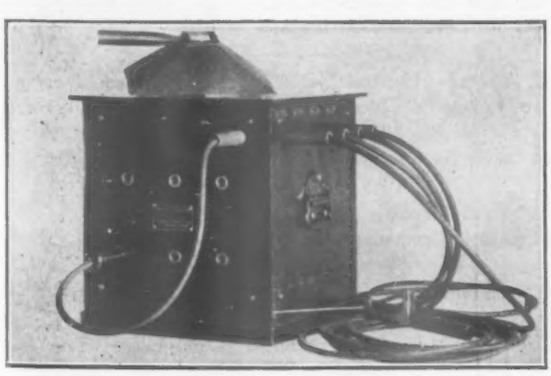

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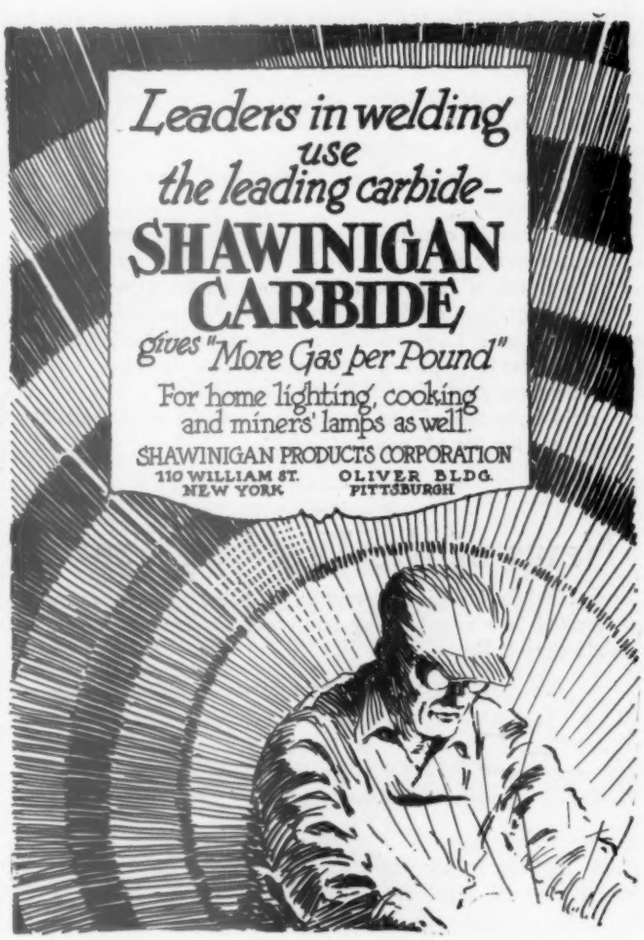

E. S. HURD LEAVES CHICAGO OFFICE OF GIBB INSTRUMENT COMPANY

E. S. Hurd, who for the past three years has been in charge of the Chicago office of the Gibb Instrument Company, as district manager, has resigned his position, effective June 1st, and after a short visit at the home office of the above company in Bay City, Mich., he plans to move to Pittsfield, Me., where he will visit his old home for several weeks before making definite plans for the future.

E. S. Hurd.

Mr. Hurd first became connected with the welding industry through his connection with the Industrial Sales Department of the Westinghouse Electric & Manufacturing Company in 1917, right after he was graduated from the University of Maine. During the war he held a commission of Second Lieutenant of Engineers.

From January, 1919, until the middle of the following year he was connected with the Electric Arc Cutting & Welding Company, as assistant general manager. In June, 1920, he joined the sales force of the Gibb Instrument Company, at Detroit, Mich., and after a year of traveling out of Detroit, took charge of the Chicago branch office.

Hurd was a charter member of the American Welding Society, and has been active in the affairs of the Chicago Section of that Society during the past three years.

UNION CARBIDE MAKES BID FOR MUSCLE SHOALS

The Union Carbide Company has submitted to the Government an offer to lease Muscle Shoals, and if their offer is accepted proposes to produce at Nitrate Plant No. 2 a new form of nitrogenous fertilizer, called "Urea." This product has been tested during the past four years by three different bureaus of the U. S. Department of Agriculture and by the New Jersey State Agricultural Experiment Station.

In every case the conclusions reached agree in the main with the statement summarizing the experiments conducted by the Fixed Nitrogen Research Laboratory in conjunction with the Bureau of Plant Industry, both of the Department of Agriculture, the "Urea seemed to be as readily available as sodium nitrate and equally as good in all respects as any other material used. Since Urea is an excellent material physically and leaves neither a basic nor an acid residue in the soil it should prove to be an almost ideal nitrogen carrier for all types of soils."

News of the Welding Trade

The Virginia Welding Company, of Charleston, Virginia, is now located in a new building built specially for welding at 116 Virginia Street, East.

M. R. McGechin is president of the East Coast Boiler & Machine Co., Inc., 131 First Court, N.W., Miami, Fla., who are remodelling a building for a boiler and tank repair works, with a well equipped acetylene welding department.

Tank making is an important part of the business of the Acme Tank & Welding Works, 168 Public St., Providence, R. I., which was recently organized by Mr. J. M. Connelly.

An office and warehouse is being constructed at 46th Street and Western Avenue by the Central Steel & Wire Company, 127 N. Peoria St., Chicago.

The Harrisburg Machine & Electric Welding Co., Eighteenth and Chestnut Sts., Harrisburg, Pa., is reported to be planning the construction of a two-story building 80x110 ft.

John J. Crowe has been appointed engineer in charge of the Apparatus Research and Development Laboratory of the Air Reduction Sales Co., at Jersey City, N. J. Mr. Crowe recently resigned his position as metallurgist in charge of the Testing and Research Laboratory at the Philadelphia Navy Yard.

L. I. Grinnell who for several years has been Manager of Publicity of the Metal & Thermit Corporation, New York City, and Mr. C. F. Lederer who has been General Supervisor of rail welding of the Metal & Thermit Corporation, recently left the services of that company. Mr. Grinnell has become connected with a real estate firm in New York City, and Mr. Lederer has returned as Superintendent of Way to the Milwaukee Electric Railway & Light Company, Milwaukee, Wis., with whom he was formerly associated.

The Chicago office of the Carbic Manufacturing Company, Duluth, Minn., has moved from 565 W. Washington Blvd., to 3914 S. Wabash Ave

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At the regular May meeting of the New York Chapter of the American Society for Steel Treating, E. E. Thum of the Linde Air Products Company was elected treasurer.

At the Sectional meeting of the American Society for Steel Treating held at Moline, Illinois, May 22nd and 23rd, A. S. Kinsey, of the Air Reduction Company read a paper on the subject of "Steel under the Oxy-acetylene Flame."

The Chicago office of the Gibb Instrument Company, Bay City, Michigan, has removed from 551 W. Van Buren St. Thos. W. Barnes is in charge as manager, with C. O. Watson continuing as assistant manager.

The Tariffville Oxygen & Chemical Co., Tariffville, Connecticut, Mr. Frederic W. Jones, President, have purchased the acetylene plant in Hartford, Connecticut, owned by the George H. Rice Co. and will commence operations under their own name June 1st, with appreciably enlarged facilities.

F. B. Toombs, General Sales Manager of the Chicago Steel & Wire Company Chicago, Illinois, recently returned from a trip to California, in which state branch offices of the above concern have been opened at Los Angeles and San Francisco.

J. C. Glaum recently joined the sales force of the Burdett Manufacturing Company, 309 St. Johns Ct., Chicago, Ill.

A branch office of the Burke Electric Company for sales and service has recently been opened at 310 S. Michigan Ave., Chicago, Illinois. Mr. M. E. Standish is in charge as manager.

The Air Reduction Sales Company, The Torchweld Equipment Company, and the Oxweld Acetylene Company were represented with exhibits of welding equipment at the convention of the Master Boiler Makers Association, which was held at the Hotel Sherman, Chicago, May 20th to 23rd.

H. B. Pearson and E. A. Faulhaber of the Burdett Oxygen Company recently made an inspection trip through the new oxygen plant of the Bettendorf Oxygen and Hydrogen Company, Bettendorf, Iowa.

At a recent meeting of Superintendents and Foremen of the John Deere Plow Company, Moline, Illinois, A. J. Russell of the Bettendorf Oxygen and Hydrogen Company, Bettendorf, Iowa, read a very interesting paper on the subject of "Production of Oxygen and Acetylene, and Their Uses in Industrial Plants."

The Taylor-Wharton Iron & Steel Company have recently issued an attractively bound twenty-four page booklet on the subject of "Putting the Right Steel on the Job." The booklet features the various kinds of steel made by the company, and the important uses of each.

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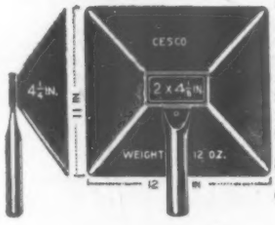

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Position Wanted—Oxy-acetylene welder with seven years' actual welding experience. Can weld any kind of metal, thoroughly familiar with tank and pipe line work. I want a steady job and am willing to go anywhere. Address H. L. Stahlman, Hoxie, Kans.

Position Wanted—Electric arc and acetylene welder wants position. Experienced in boiler and ship yard welding. Now employed as machinist. Address V. W. Andrews, 28 Brighton St., Charlestown, Mass.

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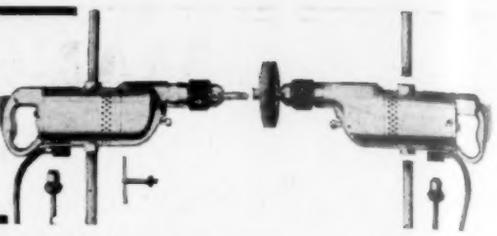

CURRENT WELDING LITERATURE

BURCO PRODUCTS FOR WELDING AND CUTTING—A catalogue of Oxy-Acetylene and Oxy-Hydrogen Welding and Cutting Apparatus has just been issued by the Burdett Manufacturing Company, Chicago, Illinois. Its introduction outlines briefly the nature of oxy-acetylene welding, and points out some of the more important industrial applications. A special section is devoted to the illustration and deseription of the gas mixing principle, and to the construction of the torches listed in the catalogue. The torches described and illustrated cover a wide range of applications such as ordinary welding, light welding, combination welding and cutting, oxy-hydrogen torches, cutting torches, lead burning and carbon burning torches. In the Regulator Section, particular attention is given to the description of the Burco Sta-Set Regulator, which has two gauges built into the body. The regulators displayed are adapted to a variety of welding and cutting conditions. Trucks are shown for transporting tanks and apparatus. The book is neatly printed and nicely illustrated. It is bound in a durable heavy hard cover.

THE WELDING OF CAST IRON FROM A METALLURGICAL POINT OF VIEW, by J. G. Pearce—A technical discussion of the influence of carbon upon iron—The influence of rate of cooling on structure—The difference between white and grey iron—The influence of other elements in cast iron on the properties and weldability. Methods of welding special irons. The conclusion is that the success attained in welding special castings depends upon solving the metallurgical problem involved. It is recommended that important welds be made dependent on the chemical and microscopical analysis on the part to be welded so that an appropriate welding rod can be made.—Acetylene and Welding Journal, London, May.

OXY-ACETYLENE REPAIR OF BRONZE BELL—Description of the procedure in welding two cracks in a bronze bell which weighs five tons. The cracks were carefully beveled and the bell was preheated for four hours, then welded with manganese bronze filler rod. Four days were allowed for cooling of the bell.—Acetylene and Welding Journal, London, May.

JIGS FOR WELDING AND CUTTING—Description and illustration of mechanical devices for speeding up welding and cutting operations which are on a production basis.—Revue de la Soudure Autogene, Paris, March.

AUTOGENOUS WELDING FROM A CHEMICAL POINT OF VIEW, by J. H. Booer—General considerations—Physical phenomena—Oxidation and Reduction—Metallic oxides—Non-Metallic oxides—Composition of the flame—Remedies for oxidations—Reducing agents and fluxes.—Revue de la Soudure Autogene, Paris, April.

BRAZING PIPE JOINTS—Description of a new method of joining lengths of cast iron gas pipe and making special joints and connections, using the oxy-acetylene flame and bronze filler rod. The joint consists of a bronze collar applied around the ends of the butted pipes. Illustrations show the design of the joints and how they respond to tests.—Sanitary and Heating Engineering, May 30th.

OXY-ACETYLENE TIPS—Monthly publication of the Linde Air Products Company. The June number contains the following articles. The manufacturing process of steel barrel welding. Cutting plate in fabricating a special caboose. Reclaiming imperfect steel forgings. A fire truck that was tailored to suit. Bending heavy steel plate. Oxy-acetylene cutting and welding for the pluming and heating contractor. Good signs and sign posts made from scrap materials. Foundry eliminates production waste by reclamation welding. Six-ton shear casting repaired.

STEEL AND ITS PROPERTIES IN RELATION TO WELDING—A paper read before the Institution of Welding Engineers, of London, by Prof. F. C. Thompson, and published in pamphlet form by the I. W. E. Price two shillings.

REACTIONS—Quarterly publication of the Metal & Thermit Corporation, New York. The first issue of this year contains the following articles: Thermit—Administering first aid to a bull—A large connecting rod repaired—Preventing a serious breakdown at the Agasote plant—Lengthening press columns by welding—Constructing roller end bearing pins by welding—Repairing a cast iron wheel press—Spreader for locomotive welding—Useful kinks in the Frisco Repair Shops—Welding in a new frame forging—Using Thermit preheater with burner for removing driving wheel tires—Reclaiming driving wheel centers in a large Eastern Railroad Shop—Welding a truck trailer frame.

AROUND THE WORLD BY AIR—Story of the beginning of the Round-the-World Flight undertaken by flyers of the United States Army. Description of the aeroplanes used, and how oxy-acetylene welding assisted in their construction.—Acetylene Journal, June.

THE MANUFACTURE OF CENTRIFUGAL CAST IRON PIPE—Details of the de Lavaud Process of manufacturing cast iron pipe for gas main installations.—Acetylene Journal, June.

WIDENING THE APPLICATION OF WELDING IN FAN MANUFACTURING, by Arthur L. Greene—Some of the reasons why manufacturers of metal goods are giving more careful consideration to the possibilities of welding. In their production are economy in manufacturing, increase in the strength, and increase in the durability of the finished article.—Acetylene Journal, June.

COST RECORDS IN A JOB SHOP—Description of a Job Welding Shop Cost Accounting System, with illustrations of the forms used in the office and in the shop.—Acetylene Journal, June.

WELDING OF MANGANESE STEEL, by S. W. Miller—Preliminary report of the Gas Welding Committee of the American Bureau of Welding. A technical discussion of the nature of manganese steel illustrated by microphotographs—Discussion of the technique of welding—Chemical analysis and heat treating. Conclusions are that under proper conditions a satisfactory oxy-acetylene weld can be made in manganese steel.—Journal of the A. W. S., May.

MANUFACTURING ALL-STEEL AUTOMOBILE BODIES, by J. W. Meadowcroft—The average amount of welding on each body is 1000 to 1100 spot welds, 70 in. to 80 in. of gas welding, and 10 in. to 12 in. of metallic arc welding. All welding is done by specialists. Joints are designed so as to facilitate assembly and to allow for contraction.—Journal of the A. W. S., May.

HINTS FOR WELDING AN ALUMINUM CASTING, by E. E. Thum—Pointing out that there are various kinds of aluminum alloys usually grouped together under the general title of Aluminum Castings. The casting most commonly found is the No. 12 Alloy. It is important to control the temperature of preheating, and not to allow the metal to become too hot while welding.—Journal of the A. W. S., May.

COMPRESSED-DISSOLVED ACETYLENE, by M. A. Dantzler—The nature of compressed acetylene and the precautions necessary in handling it. Some of the problems which confront the manufacturer of compressed acetylene.—Journal of the A. W. S., May.

FLUXES AND SLAGS IN OXY-ACETYLENE WELDING, by C. Coulson-Smith—The use of fluxes in welding mild steel, cast iron, copper, brass, bronze and aluminum.—Journal of the A. W. S., May.

RECLAMATION OF MATERIAL BY WELDING, by William I. Morgan—Photographs of important parts of heavy excavating machinery in use on large irrigation work, which were reclaimed from the scrap pile by arc welding, with some data on the savings effected by the application of the process.—American Machinist, May 22nd.

HOW MY OXY-ACETYLENE TORCH MAKES MONEY, by L. M. Bender—The average blacksmith when considering the installation of an oxy-acetylene torch wonders if he will be able to keep it busy. This article tells of some of the small jobs that are possible with the welding torch.—American Blacksmith, May.

OXY-ACETYLENE WELDING AND CUTTING ON ELECTRIC RAILWAYS, by C. E. Mitchell—Description of the oxy-acetylene process and the apparatus used—Importance of having competent operators—List of some of the jobs done by one street railway company, with data showing the cost of welding and the savings effected.—Electric Traction, May.

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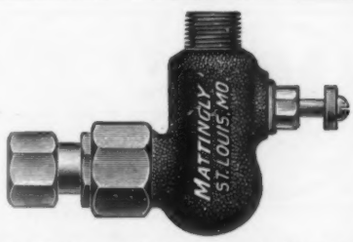

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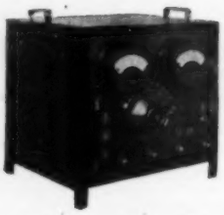

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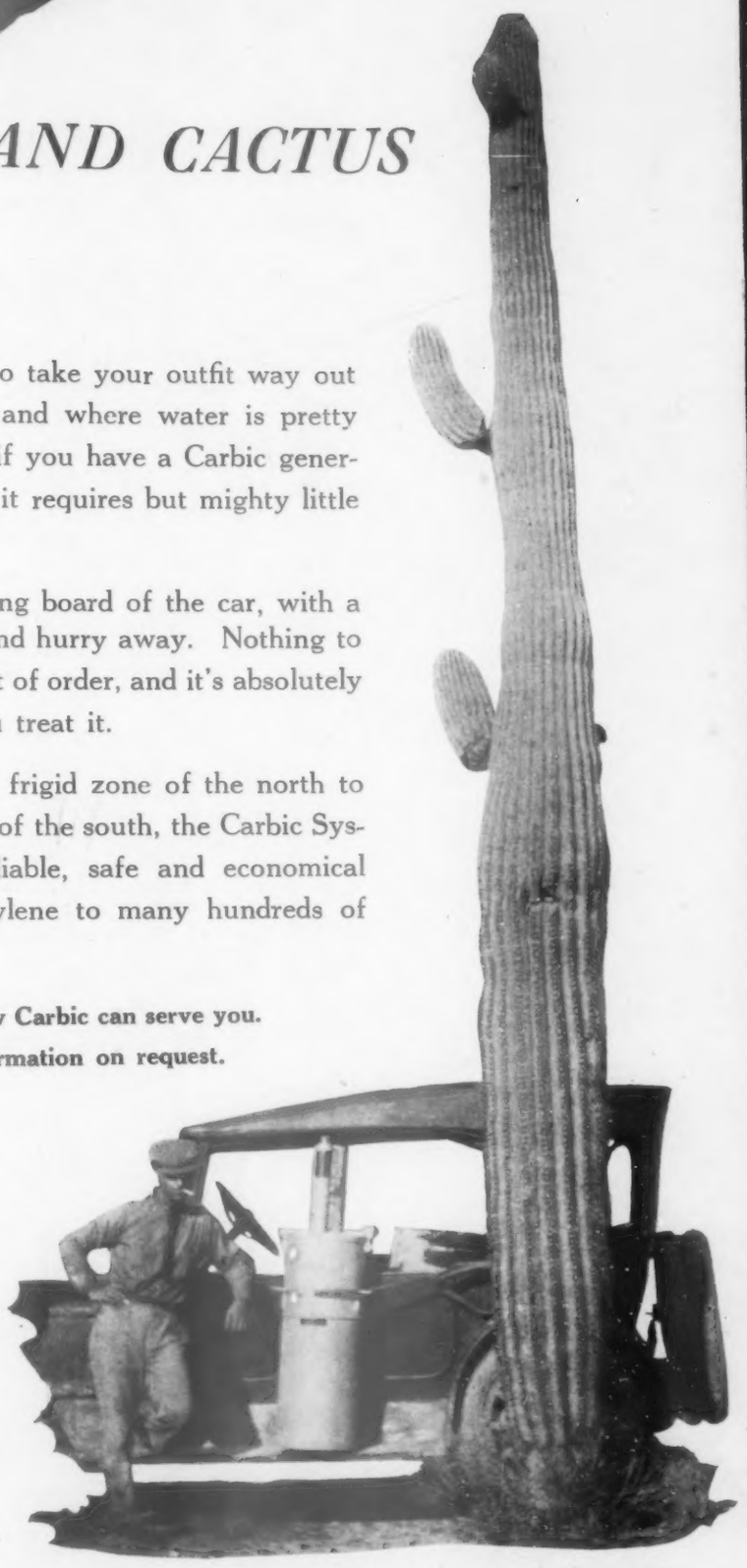

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